SELECTED

SWATERRESOURCES ABSTRACTS



VOLUME 20, NUMBER 1 JANUARY 1987

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey U.S. Department of the Interior

VOLUME 20, NUMBER 1 JANUARY 1987

W87-00001 -- W87-00831



The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1987.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

elected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the Water Resources Thesaurus. The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific Information Center U.S. Geological Survey MS 425 National Center Reston, VA 22092

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

FREALISE THERMODYNAMIC PROPERTIES FOR NATURAL WATERS COVERING ONLY THE LIMNOLOGICAL RANGE, National Sun Yat-Sen Univ., Kaohsiung (Taiwan). For primary bibliographic entry see Field 2H. W87-00569 PRECISE THERMODYNAMIC PROPERTIES

2. WATER CYCLE

2A. General

HYDROLOGY OF HUMID TROPICAL RE-

International Association of Hydrological Sci-

ences.
Available from the IAHS, 2000 Florida Ave., NW, Washington, DC. 20009. IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. Edited by Reiner Keller. 468 p.

Descriptors: *Tropical regions, *Humid climates, *Hydrology, Tropical cyclones, Hydrological regime, Hydrologic cycle, Land use, Hydrologic budget, Hydrologic models, Hydrologic data, Symposium, Conferences.

The 'humid tropics' consist of those zones with tropical rainy climates lying on either side of the equator. They extend over the lowlands of the River Amazon, the central Congo basin and along the African Guinean coast as well as over the southern Asiatic peninsula and the islands of Malaysia, Indonesia and the Philippines. In the humid tropical regions, temperature variations are less significant than seasonal variations in humidity. It is the constant solar radiation, predominance of convective rainfall with high precipitation rates, tropical cyclones, hydropedological and geomorphological processes accelerated by higher temperatures and higher amounts of moisture, which influence the hydrology of humid tropical regions. Man has radically interfered with the natural vegetation and ecology of the tropics in recent years in Man has radically interfered with the natural vegetation and ecology of the tropics in recent years in order to develop and cultivate these regions. How this has affected the ecology and in particular the hydrological process is discussed in this volume, as well as whether there is a difference between the hydrology of the tropics and the hydrology of temperate regions, and whether the methods developed for temperate climates can be directly transferred to humid tropical regions. Division titles within the book are: (1) hydrological aspects of tropical cyclones, (2) the hydrological regions of the humid tropics, (3) land use and hydrology in the humid tropics, (4) water balance and regime, and (3) inadequate data and hydrological models. (See also W87-00087 thru W87-00126) (Lantz-PTT) PTT) W87-00085

OPERATIONAL HYDROLOGY IN THE HUMID TROPICAL REGIONS. World Meteorological Organization, Geneva (Switzerland). Dept. of Hydrology and Water Re-

sources.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p 326, 1 fig. 1 tab, 62 ref.

Descriptors: *Hydrology, *Tropical regions, *Humid climates, Hydrologic properties, Hydro-logic data, Data aquisition, Measuring instruments, Forecasting, Water resources development, Water management, Model studies.

The similarities and differences which exist between operational hydrology as applied in tropical areas and that which is applied elsewhere are reviewed. On the basis of this review, operational hydrology techniques are recommended which can be adapted or transferred directly from other areas to the humid tropics. Problem areas are delineated, which are due either to the transfer of inappropriate techniques or to the lack of a solution to the specific operational hydrology problems which are specific to these areas. Suggested are research topics and their priority for solution for the problems outlined. Indicated are the areas where international organizations could most effectively assist developing countries in humid tropical regions. (See also W87-00086) (Author's abstract) W87-00086

CYCLONIC FLOODS IN THE INDIAN OCEAN (MADAGASCAR) AND THE SOUTH PACIFIC (NEW CALEDONIA AND TAHITICKRUES D'ORIGINE CYCLONIQUE DANS L'OCEAN INDIEN (MADAGASCAR) ET LE PACIFIQUE SUD (NOUVELLE CALADONIE ET TAHITI), Office de la Recherche Scientifique et Tech Outre-Mer, Noumea (New Caledonia). For primary bibliographic entry see Field 2B. W87-00087

TROPICAL STORMS IN CENTRAL AMERICA AND THE CARIBBEAN: CHARACTERISTIC RAINFALL AND FORECASTING OF FLASH

For primary bibliographic entry see Field 2B. W87-00088

RUNOFF AND FLOOD CHARACTERISTICS IN SOME HUMID TROPICAL REGIONS, National Research Center for Disaster Prevention, Sakura (Japan).

11. Kinosita.

IN: Hydrology of Humid Tropical Regions, IAHS

Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the

International Union of Geodesy and Geophysics,

Hamburg, West Germany, August 15-27, 1983. p

53-62, 7 fig, 1 tab, 11 ref.

Descriptors: *Runoff, *Floods, *Tropical regions, *Humid climates, Irrigation design, Drainage systems, Rice, Annual runoff, Annual precipitation, Rainfall distribution, Rainfall intensity, Asia.

In the humid tropical regions of Asia the staple diet is rice. To increase rice production, it is necessary to establish irrigation and drainage systems and manage these effectively. The study on runoff and flood characteristics is of vital importance in Asia. This paper first discusses annual precipitation, the spatial distribution of rainfall, and the return period of heavy rainfall. Next, annual runoff ratios, flood runoff ratios and other runoff parameters (discharge, runoff coefficient, rainfall intensity, and drainage area) are listed. They characterize the humid tropical region from the hydrological viewpoint. Finally, a flash flood based on humid tropical conditions is considered. This caused serious devastation in a limited area with heavy debris flow. (See also W87-00089) (Author's abstract) W87-00089

RAINSTORM CHARACTERISTICS AFFECTING WATER AVAILABILITY FOR AGRICUL-

TURE,
Ibadan Univ. (Nigeria). Dept. of Geography.
J. S. Oguntoyinbo, and F. O. Akintola.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg. West Germany, August 15-27, 1983. p
63-72, 6 fig., 5 tab, 9 ref.

Descriptors: *Rainfall intensity, *Rainfall distribu-tion, *Rainfall infiltration, *Available water, Agri-cultural hydrology, Tropical storms, Ibadan, Nige-ria, Soil water, Temporal distribution, Soil mois-ture retention, Soil water table.

Research on tropical rainstorm characteristics relevant to moisture availability for agricultural purposes has concentrated mainly on seasonality and variability. The characteristics - rainfall amounts, rainstorm intensity, duration of rainstorms and the sequence of rainstorm events - which determine the exact amount of moisture available have been relatively neglected. This study, based on analysis of 470 rainstorms ercorded in Ibadan between 1960 and 1980, is an attempt to examine the effect of these characteristics. It shows that most of the rainstorms at Ibadan compare favorably in their characteristics with rainstorms from other parts of the tropics. The rainstorms from other parts of the tropics. The rainstorms from other parts of the tropics. The rainstorms are short in duration and of high intensities concentrated in the early portion of their duration, leading to high excess water flow a few minutes after the start. But, for those that last long, intensities after about 30 min end up as soil moisture since they are lower than the infiltration capacities of the area. The implications of these findings, in relation to agriculture, are as follows: (a) The intensities of the rainstorms of the early and late months of the rainy season are higher than the soil infiltration capacities. These are the periods, especially the early part of the rainy season, when the soils are vulnerable to soil erosion processes due to the lack of the necessary protective cover of vegetation. It is then postulated that soil erosion rates would be very high early in the rainy season. This is, however, supported by the relatively higher concentrations of sediment in tropical rivers during the early period of the rainstorm duration. This problem will be compounded by rainstorms with double peaks. (See also W87-00086) (Lantz-PTT)

HYDROLOGICAL CHARACTERISTICS OF THE CARIBBEAN.

A. D. Arenas

A. D. Arenas.

N: Hydrology of Humid Tropical Regions, IAHS

Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
75-83, 5 fig, 5 tab, 5 ref.

Descriptors: *Hydrologic aspects, *Caribbean, *Hydrologic data, Morphology, Evaporation, Dissolved solids, Bed load, Antilles, Ialands, Isohyetal maps, Tropical storms, Hurricanes, Tropical cy-

Clones.

The term 'Caribbean', applied also to denominate the Antilles, includes thousands of islands with similar hydrological features located between latitudes 10 N and 23 N and longitude 59 W. Except for the leeward islands of the Netherlands Antilles, the mean annual rainfall in the region exceeds the world mean precipitation of 970 mm. However, in the Greater Antilles there are subhumid and semi-arid zones close to excessively rainy ones. The basins of the Greater and Lesser Antilles, including the most extensive ones, are relatively small. Most of the rivers are short and their slopes steep, while the intense rains of tropical storms cause flash floods. These islands are located in the track of hurricanes and cyclones. Tropical storms are associated with heavy rains causing catastrophic flooding. Together with the disastrous effects of torrential rains and floods, the strong winds accompanying hurricanes and cyclones cause additional damage. The morphometric characteristics of the basins, evaporation, river discharge and dissolved solids and bed load materials, are discussed for these islands. For the first time in a single paper, isohyetal maps of various islands, mean rainfall values and data on extraordinary phenomena are given. (See also W87-00086) (Lantz-PTT)

RECENT TRENDS IN ASPECTS OF HYDRO-CLIMATIC CHARACTERISTICS IN WEST AFRICA

Lagos Univ. (Nigeria). Dept. of Geography.

IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Sym-

Group 2A-General

posium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 97-104, I tab, 6 ref.

Descriptors: *Hydrology, *West Africa, *Climatic data, Rainfall, Drought, Evaporation, Precipitation, Forecasting.

In this paper, the question is discussed whether climate is changing and whether its variability has become greater in recent years, especially with particular reference to West Africa, where rainfall, and evaporation data of the last 50 - 60 years are used. The characteristics and recent variations of drought frequencies over this period are also examined while the consequences of recent droughts, particularly with respect to population and economic development of the region are discussed. The study shows that no trends towards increased variability are proven over the period considered. ane study abows that no trends towards increased variability are proven over the period considered. It also shows that although, as in other parts of the world, rainfall in West Africa varies in time and space, the same trends or variations do not necessarily occur all over the region. The study confirms previous conclusions that fluctuations of wet and dry years occur approximately every 2-3 years in West Africa. (See also W87-00086) (Author's stract) W87-00093

SCIENTIFIC AND TECHNICAL ASPECTS OF THE HYDROLOGY OF HUMID ZONES IN CENTRAL AFRICA (ASPECTS SCIENTIFIC QUES ET TECHNIQUES DE L'HYDROLOGIE DES ZONES HUMIDES DE L'AFRIQUE CEN-TRALE

J. A. Rodier. J. A. Rotter.

IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
105-126, 2 fig. 1 tab, 16 ref.

Descriptors: *Hydrology, *Humid climates, *Africa, Hydrologic regime, Hydrologic cycle, Zaire River, Soil water potential, Discharge meas-urement, Flood discharge, Discharge coefficient,

Surface runoff.

The area studied covers 5,000,000 sq km, including the 3,800,000 sq km basin of the River Zaire. The diversity of hydrological regimes is very great, especially in the eastern part. This diversity is explained by differences in slope, degree of permeability of the soils (sedimentary and volcanic zones being highly permeable), and vegetal cover. The specific mean annual discharges have been estimated for about 80 basins: their values vary from 3 to 51 ls/sq km. With 43,000 cu m/s, the Zaire River shows a specific discharge of 11.4 ls/sq km. The temporal distribution of these discharges is approximately normal with a low or very low coefficient of variation. The runoff deficit of between 800 and 1300 mm/yr is stable. Flood discharges display variations in magnitude and temporal changes similar to those shown by the annual mean. Erosion is negligible in forest areas but may be high in savannah and in cultivated areas. The paper ends by making recommendations for further studies. (See also W87-00086) (Author's abstract) W87-00094

NUTRIENT BALANCE OF A CENTRAL AMAZONIAN RAINFOREST: COMPARISON OF NATURAL AND MAN-MANAGED SYSTEMS, Frankfurt Univ. (Germany, F.R.). Dept. of Geosci-

For primary bibliographic entry see Field 6G. W87-00097

SOIL MOISTURE REGIMES AS AFFECTED BY SILVICULTURAL TREATMENTS IN HUMID EAST TEXAS,

Stephen F. Austin State Univ., Nacogdoches, TX. School of Forestry. For primary bibliographic entry see Field 2G. W87-00099

WATER YIELD RESULTING FROM CLEAR-CUTTING A SMALL HARDWOOD BASIN IN CENTRAL TAIWAN, Taiwan Forestry Research Inst., Taipei. For primary bibliographic entry see Field 4C. W87-00102

RUNOFF REGIME OF A TROPICAL HIGH MOUNTAIN REGION, Bern Univ. (Switzerland). Dept. of Hydrology. C. Leibundgut. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg. West Germany, August 15-27, 1983. p 313-324, 7 fig. 2 tab, 13 ref.

Descriptors: *Runoff regime, *Tropical regions *Mountains, Mount Kenya, River runoff, Hydrolo gical regime, Rainfall-runoff relationships Groundwater recharge, Aquifers, Rainfall.

Groundwater recharge, Aquifers, Rainfall.

Investigations concerning river runoff and water balance in the Mt Kenya region were pursued within the scope of a hydrological research project. For the northwestern Mt Kenya region, runoff data obtained from 12 stations for the period 1960-1980 are available. The runoff regimes are of the type 'equatorial regime of high mountains with two maxima'. Compared with known equatorial regimes the more extreme coefficients are the main difference. Precipitation is the main controlling factor. The study revealed that the long rains, which fall in spring and are generally the heaviest rainfall, follow the most pronounced dry season. A large part of the rainwater is used to replenish the underground reservoir. Therefore, only a relative maximum (May) is reached in the annual flow regime. The refilled aquifer and the reduced evaporation, combined with continental rains are able to supply the river discharge throughout the subsequent dry period such that, generally, larger quantities are discharged than during the first dry period. Obviously the aquifer only partially diminished so that the short rains can produce the annual maximum discharge. As a result of the amplified potential evaporation in connection with minimum rainfall, the store is subsequently diminished very quickly and extensively. An analysis of the factors potential evaporation in connection with minimum rainfall, the store is subsequently diminished very quickly and extensively. An analysis of the factors controlling the river regimes is the purpose of the current investigations. This analysis is based on altitudinal belts in order to understand the different conditions in the individual river basins. (See also W87-00086) (Lantz-PTT) W87-00111

SOME ASPECTS OF WATER BALANCE IN THE TROPICAL MONSOON CLIMATES OF

THE TROPICAL MONSOON CLIMATES OF INDIA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
V. P. Subrahmanyam.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p
325-331, 4 fig, 1 tab, 8 ref.

Descriptors: *Hydrologic budget, *Tropical regions, *Monsoons, *India, Rainfall intensity, Economic aspects, Atmospheric physics.

India is a spectacular example of the monsoon climates of the Asian tropics. Monsoons are defined as the seasonal winds blowing in almost opposite directions in summer and winter; it is mainly the summer monsoon that is of economic importance because of its rainfall potential. The climatic water balances of three representative stations situated in the arth of the suppers continued. climatic water balances of three representative sta-tions situated in the path of the summer southwest monsoon are discussed. The results indicate that the water balances change from humid to arid as one proceeds from south to north over the coun-try. One of the significant conclusions that has emerged from this study is that the concept of monsoons as regions or periods of heavy down-pour of rainfall supporting forest vegetation is not in fact quite correct. They must be viewed as only one aspect of the general circulation of the atmos-

phere in the tropics and rainfall associated with this circulation is neither the same nor constant everywhere. It is the complex interaction between this circulation and the geography and the physiography of the region that generates a range of climates varying between the perhumid and the arid depending upon the nature and the extent of the interaction. The Indian region being an outstanding example of the Asiatic tropical monsoon affords strong evidence supporting this concept, perhaps necessitating a revision of the definition of monsoon climates from an ecological angle. (See also W87-00086) (Lantz-PTT)

HYDROLOGICAL STUDIES OF THE IRRAWADDY DELTA,
Halcrow (William) and Partners, Swindon (Eng-

For primary bibliographic entry see Field 2E. W87-00115

RECENT HYDROLOGICAL AND CLIMATO-LOGICAL ACTIVITIES IN THE AMAZON BASIN, BRAZII, Projecto de Hidrologia e Climatologia da Ama-zonia, Belem (Brazii). V. Elias, and A. J. S. Cavalcante.

V. Elias, and A. J. S. Cavalcante.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
365-373, 6 fig. 1 tab, 4 ref.

Descriptors: "Hydrologic aspects, "Climatology, "Amazon River, "Brazil, "Hydrologic data, Hy-drologic models, Water management, Telemetry, Water level, Precipitation, Temperature, Model studies, Water use, Geostationary satellite, GEOS, Remote sensing, Tocantins River.

Remote sensing, Tocantins River.

The Brazilian Government in cooperation with the United Nations Development Programme (UNDP) and the World Meteorological Organization (WMO) is developing large-scale studies to improve the hydrological and meteorological knowledge of the Amazon basin. All the existing hydrological and climatological data, together with information on land use, land cover, physiographical and other characteristics are being stored and respectively completed by computer interpolation using the so called 'square grid technique'. From the various options available the GOES (geostationary satellite) telemetry system was recommended as a means of acquiring hydrometeorological data in the Amazon basin. Telemetry is used to monitor the operation of stations in remote areas and also to provide real time data for operational purposes. The first phase of the overall plan, the installation of 10 data collecting stations (DCPs) in the 750,000 sq km Tocantins sub-basin and the establishment of a ground receiving station at Sao Jose dos Campos has been achieved. The data collecting stations transmit water level, precipitation, air temperature, relative hummidity, barometric pressure and battery voltage at 3 h intervals. The DCP antannae are aimed midway between the active satellite and the spare satellite, that is at 90 degrees W longitude, so that communication is assured if a failure on the active satellite should take place. A hydrological conceptual model for the tributary sub-basins and a channel routing assured if a failure on the active satellite should take place. A hydrological conceptual model for the tributary sub-basins and a channel routing model were developed for the middle and lower Amazon. Their operational use for water stage and discharge forecasting in Manaus and Obidos assists navigation, agriculture and flood warnings. (See also W87-0086) (Lantz-PTT)

EFFECTS OF METEOROLOGICAL INPUTS ON THE VARIABILITY OF RUNOFF WITH TIME,

Belgrade Univ. (Yugoslavia). Faculty of Agricul-

ture. S. Jovanovic, M. Jovanovic, and Z. Radic. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the

International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 375-385, 9 fig, 4 ref.

Descriptors: *Meteorology, *Runoff rates, *Time series analysis, Mathematical models, Rainfall-runoff relationships, Hydrographs, Flood peak, Storms, Storm runoff.

Storms, storm runoff.

The influence of storm movement velocity and direction upon the variability of runoff with time is investigated and discussed. Different synthetic storm models are used as meteorological inputs for the mathematical model of runoff. The results show that the spatial distribution of rainfall and the dynamics of the phenomenon have an important effect on the shape of the runoff hydrograph. Floods of great magnitude are to be expected if the storm welocity is small, even at moderate rainfall intensities. In this respect, peak discharges are greater if the storm is moving downbasin than if it is moving upbasin. The differences in the shape of runoff hydrographs are less apparent as the storm movement velocity increases. Peak discharge attentuation is also evident at higher storm propagation rates. (See also W87-00086) (Author's abstract) stract) W87-00117

DYNAMIC MODEL FOR DETERMINATION OF SOIL MOISTURE BUDGET AND ITS AP-PLICATION, Hochschule der Bundeswehr Muenchen, Neubi-berg (Germany, F.R.). For primary bibliographic entry see Field 2G. W87-00118

HYDROLOGICAL COMPUTATIONS FOR WATER RESOURCES DEVELOPMENT WITH INADEQUATE DATA, J. A. Rodier.

INALEGUATE
J. A. Rodier.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 447-458, 19 ref.

Descriptors: *Water resources development, *Hydrologic aspects, *Runoff forecasting, *Mathematical analysis, Hydrologic data, Basins, Hydrographs, Statistical analysis, Annual runoff, Rainfall-runoff relationships.

runoff relationships.

Preliminary operations such as data checking, gap filling and field surveys, together with a thorough analysis of the physical factors controlling runoff, are all absolutely necessary. For most parts of a zone the runoff deficit is stable (exhibiting variations with precipitation, temperature and physiographic factors) permitting an estimation of annual runoff. For small basins formulae derived from representative basins give annual runoff in terms of most of its determining factors. Combined with the unit hydrograph these representative basins permit the computation of the 10 year flood for ungauged basins. For larger basins, one may derive long time series of computations by using correlations between discharge data from neighboring stations (mean or maximum discharge). In general, the distribution curves are not far from normal, with a low coefficient of variation, but the pseudo-cycles of wet and dry years cause perturbations. Areas that are relatively dry or affected by cyclones present difficult problems. (See also W37-00086) (Author's abstract)

ESTIMATION OF PARAMETERS OF THE DISCRETE, LINEAR, INPUT-OUTPUT MODEL, Academia Sinica, Beijing (China). Inst. of Geogra-

phy. G. -T. Wang, and Y. -S. Yu. Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 15-30, June 15, 1986. 1 fig, 2 tab, 15 ref.

Descriptors: *Input-output analysis, *Model studies, *Parametric hydrology, *Rainfall-runoff relationships, Mathematical analysis, Statistical analysis, Hydrologic properties, Correlation analysis, Linear programming.

Discrete forms of some classic continuous parametric models of linear deterministic hydrology can be obtained directly from the more general Box-Jenkins model (Muskingum model, N-linear reservoir model, and Kulandaiswamy's model). A six-parameter model is used to simulate the rainfall-runoff relationship for a small basin. Four different methods (least-squares model, correlation-function model, linear programming, and quadratic programming) are used to estimate the model parameters. A comparison of the unit hydrographs obtained from the model using different sets of estimated parameters with the original unit hydrograph shows that the quadratic programming and the least-squares estimates give slightly lower outflows and the linear programming estimates yield outflows on the high side. (Lantz-PTT)

USE OF THE CHLORIDE ION IN DETERMIN-ING HYDROLOGIC-BASIN WATER BUDGETS - A 3-YEAR CASE STUDY IN THE SAN JUAN MOUNTAINS, COLORADO, USA, Geological Survey, Denver, CO. For primary bibliographic entry see Field 2K. W87-00154

APPLICATION OF A RAINFALL-RUNOFF FLOOD ROUTING MODEL TO A TROPICAL CATCHMENT, Snowy Mountains Engineering Corp., Cooma (Australia).

For primary bibliographic entry see Field 2B. W87-00189

HYDROLOGIC RESEARCH ON COASTAL PLAIN WATERSHED OF THE SOUTHEAST-ERN UNITED STATES,
For primary bibliographic entry see Field 7A.
W87-00204

SAHEL RAINFALL AND WORLDWIDE SEA TEMPERATURES, 1901-85, British Meteorological Office, Bracknell (England). For primary bibliographic entry see Field 2B. W87-00268

NEW FORMULATION OF EDDY DIFFUSION

NEW FORMULATION OF EDDY DIFFUSION THERMOCLINE MODELS, Salford Univ. (England). Dept. of Mathematics and Computer Science. For primary bibliographic entry see Field 2H. W87-00293

STOCHASTIC CHARACTERISTICS OF RAIN-FALL-RUNOFF PROCESSES IN ZAMBIA, National Council for Scientific Research, Lusaka (Zambia). Water Resources Research Unit. T. C. Sharma. Hydrological Sciences Journal HSJODN, Vol. 30, No. 4, p 497-512, December 1985. 7 fig, 3 tab, 6 ref.

Descriptors: *Rainfall, *Runoff, *Zambia, *Catchment areas, *Stcchastic hydrology, *Stochastic process, *Stochastic models, *Seasonal variation, *Runoff forecasting, Probabilistic process, Model

Monthly and annual rainfall and runoff sequences from drainage basins in Zambia were subjected to stochastic analysis. Rainfall sequences tended to follow the normal probability distribution and runoff sequences the lognormal probability distribution. The deterministic periodic component explained more that 60% of the variance in the log-transformed monthly runoff sequences. The stochastic component behaved as a random process in the monthly rainfall sequences and as an autoregressive moving average process in the monthly runoff sequences. The annual rainfall sequences resembled a random process and the annual runoff sequences a Markov or first order autoregressive sequences a Markov or first order autoregressive process. First order linear discrete dynamic models represented the interaction between rainfall and runoff processes on both monthly and annual

bases. The runoff models performed satisfactorily for one-step-ahead forecasting. (Author's abstract) W87-00404

EFFECTS OF TILLAGE AND RAINFALL SIM-ULATION DATE ON WATER AND SOIL

LUSSES, Wisconsin Univ.-Madison. Dept. of Soil Science. B. J. Andraski, D. H. Mueller, and T. C. Daniel. Soil Science Society of America Journal SSSID4, Vol. 49, No. 6, p 1512-1517, November-December 1985. 3 tab, 29 ref.

Descriptors: *Soil erosion, *Agricultural runoff, *Cultivation, *Rainfall, *Runoff volume, *Soil water, *Runoff, Tillage, Rainfall simulations, Residue cover, Sediments, Soil conservation.

due cover, Sediments, Soil conservation.

A rainfall simulator was used at various times during the growing season over a 4-year period to compare water and soil loses from conventional (moldboard plow-CN) and three conservation till-age (CT) treatments: chisel plow (CH), till-plant (TP), and no-till (NT); and to observe major trends in runoff volumes as a function of rainfall simulation date. Trials were conducted in September 1980, June and July 1981, October 1982, and June and July 1983. Runoff volumes for CT treatments were consistently less than those observed for CN. For CT treatments, the volume of runoff (per unit rainfall) averaged 11, 20 and 52% lower than that observed for CN for the June 1983, July 1981 and 1983, and October 1982 sampling periods, respectively. Only the CH treatment significantly reduced runoff relative to CN soon after planting. Among CT treatments, CH was significantly more effective in reducing runoff in September 1980. An increase in residue cover consistently resulted in a decrease in sediment concentrations and, most often, a decrease in soil loss. Across all sampling periods, the NT treatment consistently decreased soil loss by 80 to 90% relative to CN, while soil losses for the CH and TP treatments varied, ranging from about 45 to 90% less than those for CN. (Peters-PTT) (Peters-P1 W87-00605

RELATIONSHIP BETWEEN THE RUNOFF CURVE NUMBER AND HYDROLOGIC SOIL

PROFERTIES, Southern Illinois Univ. at Carbondale. Dept. of Plant and Soil Sciences. S.-K. Chong, and T.-M. Teng. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 1-7, April 15, 1986. 1 fig, 2 tab, 18 ref.

Descriptors: *Soil water retention, *Runoff, *Infiltration rate, *Sorptivity, *Rainfall, F-tests, Statistical analysis, Molokai, Hawaii, Regression equation,

The maximum soil water retention (S), saturated infiltration rate (K sub sat), and sorptivity (S sub 0), were collected simultaneously from rainfall experiments. The statistical results showed that S and K sub sat are highly related. In the estimation of S value, the coefficient of determination and standard error of estimate can be improved further by adding sorptivity in the regression analysis. Both sequential and partial F-tests showed that K sub sat was much more important than S sub 0 in predicting S. The regressed equation for S of the Molokai (Hawaii) soil series was applied to predicting the curve number value of other soils. The results were favorable with coefficient of determination 0.8258 and standard error of the estimate = 5.3187. (Rochester-PTT) W87-00631

CHOICE OF EXTREMAL MODELS BY AKAIKE'S INFORMATION CRITERION, Lisbon Univ. (Portugal).
For primary bibliographic entry see Field 7C. For primar; W87-00672

REPRESENTATION OF FLOWS TO PARTIAL-LY PENETRATING RIVERS USING GROUND-WATER FLOW MODELS,

Group 2A-General

University Coll., Cardiff (Wales). Dept. of Civil and Structural Engineering.
For primary bibliographic entry see Field 2F.

Descriptors: *Rainfall-runoff relationships. *Simulationships.*

NONLINEAR MODELS OF DYNAMIC HY-DEOLOGY,
Polish Academy of Sciences, Warsaw. Inst. of

Geophysics vice and J. J. Napiorkowski.
Hydrological Sciences Journal HSJODN, Vol. 31,
No. 2, p 163-185, June 1986. 9 fig. 1 tab, 37 ref.

Descriptors: *Model studies, *Hydrologic models, *D_namics, *Flood routing, *Rainfall-runoff relationships, Rainfall, Runoff, Hydrologic cycle, Mathematical models, Mathematical analysis, Vol-

Methods of describing nonlinear effects in dynamic hydrological systems were surveyed, with particular reference to those sorts of nonlinear methods which do not require significantly more computational effort in comparison with classical linear models. If, within a given class of problems, a rigorous nonlinear hydrodynamic model is available, it is likely to outperform most of the nonlinear models of other types (conceptual or black box system models). If there is no superior hydrodynamic model or if the process is too complicated to be modelled by fluid mechanics laws alone, it may be worthwhile to use a nonlinear model of the conceptual or black box type. In this latter category it is advantageous to use the Volterra integral series, that has been proved to perform well for both rainfall-runoff modelling and flood routing. It is best to continue sudies on very simple nonlinear models which could be of good value if large differences between the simplicity of the linear integreal operator and the apparent complexity of either the Volterra series or the nonlinear hydrodynamic model, discourages the user from applying the more sophisticated method In such a sirvent either the Volterts series or the nonlinear hydrodynamic model, discourages the user from applying the more sophisticated method. In such a situe, the use of a multilinear model or of a conceptual nonlinear model should be seriously considered. (Lantz-PTT)

W87-00773

AFFLICATION OF VOLTERRA SERIES TO MODELLING OF RAINFALL-RUNOFF SYS-TEMS AND FLOW IN OPEN CHANNELS, Polish Academy of Sciences

Poisi Academy of Geophysics.

J. J. Napiorkowski.

Hydrological Sciences Journal HSJODN, Vol. 31, No. 2, p 187-203, June 1986. 4 fig, 21 ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Open channels, *Open-channel flow, *Channel flow, Reservoirs, Surface runoff, Hydrology, Channels, Volterra model, Flow profiles, Mathematical analysis.

A black box analysis is combined with a conceptual model approach to model rainfall-runoff systems and flow in open channels. To describe the nonlinear behavior of the systems, a model in the form of a second-order approximation of a cascade of nonlinear reservoirs was used. Such a model is equivalent to the first two terms of the Volterra series. A number of methods of solving that problem is presented. One of them (the method based on a nonlinear cascade) provides a relatively simple solution. According to this approach the kernels are sought in a subset defined in terms of quasi-physical characteristics. Applications of the Volterra model based on a nonlinear cascade to the modeling of flow in open channels and of surface runoff systems, indicate that the proposed model can indeed be used to represent systems with nonlinear dynamic and linear static behavior. (Lantz-PTT) W87-00774

VARIABLE SOURCE AREAS AND STORM-FLOW GENERATION: AN UPDATE OF THE CONCEPT AND A SIMULATION EFFORT, Georgia Univ., Athens. School of Forest Re-P. Y. Bern

urnal of Hydrology JHYDA7, Vol. 79, No. 3/4,

Descriptors: "Ramman-funoff relationships, "Simulation, "Stream discharge, "Storm seepage, "Storm runoff, Runoff, Basins, Flow, Seepage, Mathematical studies, Surface runoff, Vegetation effects, Soil

water.

The variable source area concept of streamflow and storm-flow generation proposes that the area of land yielding surface water to streamflow varies with time and that, for vegetated basins, subsurface flow not only sustains baseflow but is also a major component of storm flow. Results from a growing number of trench and tracer studies strongly support the concept. VSAS2 is a deterministic storm-flow simulator for small forested basins based on the variable source area concept. Basins are divided into a number of sub-basins or segments. In each segment, subsurface flow is reduced to a two-dimensional flow problem while the third dimension is represented by segment convergence or divergence to the stream. The irregular, time-varying grid attempts sensitive representation of the variable channel system, while keeping grid size within computational feasibility. Mathematical stability of the explicit solution is secured by proper combinations of time and space increments. The performance of VSAS2 on a 24 ha Georgia Piedmont basin is poor for large winter storms and small summers storms (discrementies are treated to performance of VSAS2 on a 24 in a Conga Free-mont basin is poor for large winter storms and small summer storms; discrepancies are traced to inadequate representation of both micro-relief and soil-water properties. (Author's abstract) W87-00779

GROUNDWATER FLOW INTO LAKE MICHI-GAN FROM WISCONSIN, Wisconsin Univ.-Milwaukee. Dept. of Geological

Sciences.
D. S. Cherkauer, and B. R. Hensel.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 261-271, May 30, 1986. 3 fig, 3 tab, 15 ref.
Federal Grant NA80AA-D-00086, Project 144-

Descriptors: *Groundwater movement, *Lake Michigan, *Geohydrology, *Pumping, Sensitivity analysis, Mathematical models, Wisconsin, Lake shores, Runoff, Flow profiles, Mathematical stud-

A detailed hydrogeological study conducted done at six sites from Wind Point to Peninsula Park along the Lake Michigan shoreline in Wisconsin. At each site a flux of groundwater to the lake was calculated for both natural conditions and the existing conditions created by pumping. The values from each site then were extrapolated to the entire portion of the total shoreline having similar hydrogeology in order to calculate a total flow of groundwater to the lake. Sensitivity analysis with a digital model was used to define limits on the similarity of hydrogeologic conditions. The net flow calculated was \$80-880 cu m/day per km of shoreline, which falls within the previously published range of 110-8,200 cu m/day per km Human activity may have reduced the natural flow as much as 15%. The estimated natural flow is between 7 and 11% of the surface water contribution to the lake in the study area. (Author's abstract) W87-00813

2B. Precipitation

COMPARISON OF EXPERIMENTAL DESIGNS TO DETERMINE EFFECTS OF ACIDIC PRECIPITATION ON FIELD-GROWN SOY-

BEANS, Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
For primary bibliographic entry see Field 5C.
W87-00043

CLOUD WATER: AN IMPORTANT VECTOR OF ATMOSPHERIC DEPOSITION, Oak Ridge National Lab., TN. Environmental Sciences Div.

For primary bibliographic entry see Field 5B. W87-00044

REGIONAL ASSESSMENT OF POTENTIAL SENSITIVITY OF SOILS IN THE EASTERN UNITED STATES TO ACID PRECIPITATION, Oak Ridge National Lab., TN. Environ ences Div.

For primary bibliographic entry see Field 5C. W87-00075

RESEARCH ON EVOLVING DESIGN AND EVALUATION OF THE HIPLEX PROGRAM: FINAL TECHNICAL REPORT, South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences. For primary bibliographic entry see Field 3B. W87-00083

HYDROLOGY OF HUMID TROPICAL RE-

International Association of Hydrological Sci-

For primary bibliographic entry see Field 2A. W87-00085

CYCLONIC FLOODS IN THE INDIAN OCEAN (MADAGASCAR) AND THE SOUTH PACIFIC (NEW CALEDONIA AND TAHITI(KRUES D'ORIGINE CYCLONIQUE DANS L'OCEAN INDIEN (MADAGASCAR) ET LE PACIFIQUE SUD (NOUVELLE CALADONIE ET TAHITI), Office de la Recherche Scientifique et Techniq Outre-Mer, Noumea (New Caledonia).

J. Panious.

IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
29-37, 9 fig, 1 tab.

Descriptors: *Cyclonic precipitatioa, *Tropical cyclones, *Floods, *Madagascar, *New Caledonia, *Tahiti, Precipitation excess, Rain gages, Flood hydrographs, Flood discharge, Storm runoff, Flood peak.

The precipitation characteristics of New Caledonia and Tahiti and the trajectories of depressions, tropical storms and hurricanes in the Indian Ocean and Southwest Pacific are described. Direct methods of measurement on networks are discussed with examples of the estimation of maximum instantaneous discharges and runoff volumes. The results make it possible to site several maximum discharges known for these countries. However, though some peak floods constitute worldwide records, it appears that those records which are known on recent networks cannot be considered if the recurrence intervals are greater than 50 years. (See also W87-00086) (Author's abstract) W87-00087

TROPICAL STORMS IN CENTRAL AMERICA AND THE CARIBBEAN: CHARACTERISTIC RAINFALL AND FORECASTING OF FLASH

FLOODS, A. D. Arenas. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1993. Proceedings of a Sym-posium Held at the 18th General Assembly of the international Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 39-51, 11 fig, 4 tab, 15 ref.

Descriptors: *Tropical storms, *Central America, *Caribbean, *Forecasting, *Rainfall intensity, *Flash floods, Rainfall distribution, Rainfall rate, Time series analysis, Storms, Warning systems, Statistical analysis.

The hydrology of the countries within the Caribbean region is characterized by frequent torrential rains and flash floods. Heavy rains may occur throughout the year, but the more intense ones are associated with or mainly produced by tropical storms. During the seven months from May to November, the conditions are favorable for generating great floods. Rainfall higher than the mean annual rainfall may be registered in only one

Precipitation—Group 2B

storm, while in a single day precipitation can be greater than the annual total for many temperate countries. Time series of rainfall and rain intensity, and also of discharge, frequently reach values which do not have a good fit to the distribution functions commonly used in hydrological studies. Warning systems based on forecasts using methods applicable to large continental basins of to phenomena with different origins are normally unsuitable to the very small basins of this region. (See also W87-00088) (Author's abstract)

RAINSTORM CHARACTERISTICS AFFECTING WATER AVAILABILITY FOR AGRICUL-TURE, Ibadan Univ. (Nigeria). Dept. of Geography. For primary bibliographic entry see Field 2A. W87-00090

SOME ASPECTS OF WATER BALANCE IN THE TROPICAL MONSOON CLIMATES OF

THE TROPICAL MONSOON CLIMATES OF INDIA, Andhra Univ., Waltair (India). Dept. of Meteorol-ogy and Oceanography. For primary bibliographic entry see Field 2A. W87-00112

ESTIMATION OF AREAL PRECIPITATION, Kwara State Coll. of Technology, Ilorir (Nigeria). Dept. of Survey. A. K. Bagchi. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Sym-posium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 345-351, 5 fig, 3 ref.

Descriptors: *Areal precipitation, *Precipitation intensity, Precipitation rate, Remote sensing, Temporal distribution, Spatial distribution, Statistical analysis, Orographic precipitation, Mountains.

poral distribution, Spatial distribution, Statistical analysis, Orographic precipitation, Mountains. Hydrological phenomena in many areas of the tropics are influenced by the presence of mountains. It is very difficult to estimate the surface water volume originating in the mountainous region because in general, only very few rain/snow gauges are available in these areas. Furthermore, the few existing data collection stations are almost invariably situated in the lower regions. This paper investigates these aspects and presents a method for the estimation of areal precipitation, in form and quantity, in highly contorted terrain. A self imposed condition is that no data are used which are not normally available in an average mountainous basin. The determination of the pattern of the orographic variation of precipitation is based upon the implied assumption that precipitation variation is strongly correlated to elevation. Previous experiments carried out in situ and their analyses are based on point precipitation data. The temporal and spatial variability of point precipitation, especially in the mountains, is such that they should be considered of rather limited value in areal precipitation variation pattern shows much less temporal variation. The beta factors have been calculated using 1975-1976 to 1978-1979 data. They satisfy the requirements of the chi-square test. If the recorded precipitation at the base (P sub ii) is the precipitation at the base that they satisfy the requirements of the chi-square test. If the recorded precipitation at he base (P sub ii) is the precipitation. The zonal values are not likely to be correct on a day-to-day basis because of gauge catch deficiency and variation of point precipitation which may not be related to the areal value. The methodology has not been tried in any other basin. (See also W87-00086) (Lantz-PTT) W87-00114

HYDROLOGICAL COMPUTATION FOR WATER RESOURCES DEVELOPMENT WITHIN IMO RIVER BASIN, NIGERIA, Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Civil Engineering.

For primary bibliographic entry see Field 7C. W87-00120

SLANTING HOLE RAINGAUGE PROPOSED FOR HILLSLOPE HYDROLOGY, National Chunghsing Univ., Taichung (Taiwan). Dept. of Soil and Water Conservation. For primary bibliographic entry see Field 7B. W87-00125

APPLICATION OF A RAINFALL-RUNOFF FLOOD ROUTING MODEL TO A TROPICAL

FLOOD ROUTING MODEL 10 A 1800 CATCHMENT,
Snowy Mountains Engineering Corp., Cooma (Australia).
D. C. Black, M. D. Mohd Nor, and B. N. Gunter.
Proceedings of the Institution of Civil Engineers,
Part 2, Vol. 81, p 1-19, March 1986. 7 tab, 10 fig, 6

Descriptors: *Rainfall-runoff relationships, *Tropi-cal regions, *Flood routing, Regional stormwater model, Malaysia, Catchment areas, Hydrographs, Bekok River, Lenik River, Sembrong River.

A rainfall-runoff flood routing model, known as the Regional Stormwater Model, was applied to a group of Malaysian catchments. The model was calibrated and tested using data from selected historical floods in the catchments studied. A consistent and physically realistic set of model parameter values was obtained in the calibration, in spite of complications such as water spilling out of, or into, the catchments studied during floods. With these parameter values, the model gave satisfactory reproduction of observed hydrographs. The model calibration was considered adequate to apply statistical rainfall and Probable Maximum Precipitation estimates to determine design floods for proposed flood mitigation works on the three rivers (Bekok River, Lenik River, and Sembrong River). (Alexander-PTT) ander-PTT)

FREQUENCY DISTRIBUTION OF RAINDROP

FREQUENCY DISTRIBUTION OF RAINDROP SIZES, Pittsburgh Univ., PA. Dept. of Civil Engineering. R. G. Quimpo, and A. B. Brohi. Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 112, No. 2, p 119-129, May 1986. 5 tab, 4 fig. 24 ref.

Descriptors: *Rain, *Frequency distribution, *Storms, Engineering applications, United States, Kolmogorov-Smirnov test.

Knowledge of the distribution of raindrop sizes during a storm is important in many engineering applications. Since drop size information is usually expressed parametrically, it is important that the proper model to describe the distribution be used. On the basis of observed frequencies, the lognormal and upper limit distributions were tested on raindrop size data taken from different sites in the United States and for different rainfall rates. After estimating parameters by the melthod of maximum likelihood, the Kolmogorov-Smirnov test indicates that the lognormal distribution provides a better representation than all the other models examined. Of the four models for raindrdop size frequency distributuions, the exponential form was found inadequate. The normal or Gaussian model, which was implied by the work of Marshall and Palmer, was also ruled out because of the almost universal asymmetry of drop size distribution data. (Alexander-PTT) asymmetry der-PTT) W87-00197

RAINFALL AND DECOMPOSITION IN THE CHIHUAHUAN DESERT,
New Mexico State Univ., Las Cruces. Dept. of Botany and Entomology.
For primary bibliographic entry see Field 2G. W87-00234

SAHEL RAINFALL AND WORLDWIDE SEA TEMPERATURES, 1901-85, British Meteorological Office, Bracknell (Eng-

land). C. K. Felland, T. N. Palmer, and D. E. Parker. Nature, Vol. 320, No. 6063, p 602-607, 17 April 1986. 3 fig, 1 tab, 30 ref.

Descriptors: *Sahel, *Sea surface temperatures, *Climatology, History, El Nino events, Soil water, Albedo, Africa, Climatic data.

Using the comprehensively quality-controlled Meteorological Office Historical Sea Surface Temperature data set (MOHSST), it is shown that persistently wet and dry periods in the Sahel region of Africa are related strongly to contrasting patterns of sea-surface temperature (SST) anomalies on a near-global scale. The anomalies include relative changes in SST between the hemispheres, on timescales of years to tens of years, which are most pronounced in the Atlantic. Experiments with an 11-level global atmospheric general circulation model support the idea that the worldwide SST anomalies modulate upper Sahel rainfall through changes in tropical atmospheric circulation. El Nino events also may play a part. It is suggested that SST have a more fundamental influence on Sahel rainfall than the effects of soil moisture and albedo changes in the Sahel. (Rochester-PTT)

INFLUENCE OF SAHARAN DUST ON THE RAIN ACIDITY AND ATMOSPHERIC INPUT TO THE MEDITERRANEAN, Institut de Biogeochimie Marine, Paris (France). For primary bibliographic entry see Field 5B. W87-00269

ANALYSIS OF THE SULFUR BUDGET AND INTERSTATE SULFUR TRANSPORT FOR COLORADO,
Environmental Defense Fund, Washington, DC. For primary bibliographic entry see Field 5B. W87-0028

CHEMICAL DIFFERENCES BETWEEN EVENT AND WEEKLY PRECIPITATION SAMPLES IN NORTHEASTERN ILLINOIS, Argonne National Lab., IL. Environmental Research Div. For primary bibliographic entry see Field 5B. W87-00283

TRACE ORGANIC COMPOUNDS IN RAIN - IL GAS SCAVENGING OF NEUTRAL ORGANIC

GAS SCAVENGING OF NEUTRAL ORGANIC COMPOUNDS, Oregon Graduate Center, Beaverton. Dept. of Chemical, Biological, and Environmental Sciences. For primary bibliographic entry see Field 5B. W87-00285

TRACE ORGANIC COMPOUNDS IN RAIN-III. PARTICLE SCAVENGING OF NEUTRAL ORGANIC COMPOUNDS,

Oregon Graduate Center, Beaverton. Dept. of Chemical, Biological, and Environmental Sciences. For primary bibliographic entry see Field 5B. W87-00258

PRECIPITATION CHEMISTRY AFFECTED BY DIFFERENCES IN LOCATION OF COLLECTION SITES AND STORAGE METHODS, Maritimes Forest Research Centre, Fredericton (New Brunswick).

M. K. Mahendrappa.
Atmospheric Environment ATENBP, Vol. 19, No. 10, p 1681-1684, October 1985. 1 fig, 1 tab, 10 ref.

Descriptors: *Rainfall, *Water storage, *Storage methods, *Acid rain, Pollution, Point source, Pre-

The possible differences in measured concentra-tions of hydrogen, nitrate and sulfate ions in 'bulk' precipitation samples that may be caused by vari-ations in location of rain collectors, and duration and temperature of storage were evaluated. Stor-age of precipitation samples up to 1 month both in

Group 2B-Precipitation

the coldroom and in the field resulted in a signifithe coldroom and in the field resulted in a signifi-cant reduction in the concentration of nitrate in the precipitation samples. Levels of sulfate ions were not found to be significantly affected by storage either in the field or in the coldroom. Samples collected from a rain gage located on a building roof were more acidic than those collected in open spaces in forests. All the samples showed the same seasonal patterns in the concentrations of sulfate and nitrate, but the individual values consistently differed from each other. (Khumbatta-PTT)

SOURCE APPORTIONMENT OF WET SUL-FATE DEPOSITION IN EASTERN NORTH AMERICA, Massachusetts Inst. of Tech., Cambridge. Energy

nary bibliographic entry see Field 5B.

DIURNAL VARIATION OF DEEP CONVECTION AND INFERRED PRECIPITATION IN THE CENTRAL TROPICAL PACIFIC DURING JANUARY-FEBRUARY 1979,
Washington Univ., Seattle. Dept. of Atmospheric

M. D. Albright, E. E. Recker, R. J. Reed, and C.

R. Dang. Monthly Weather Review, Vol. 113, No. 10, p 1663-1680, October 1985. 17 fig, 24 ref. NSF, NOAA Grant ATM 8103697.

Descriptors: "Meteorology, "Deep convection, "Precipitation, "Central tropical Pacific Ocean, "Remote sensing, Kinetics, Infrared satellites, Di-urnal variation, Vertical motion.

Infrared satellite data are used to determine the Infrared satellite data are used to determine the diurnal variation of deep convection and inferred rainfall in the central tropical Pacific. The parameter employed to characterize the convection is the percent coverage of 1.5 degrees latitude-longitude squares by clouds with tops colder than various specified equivalent blackbody temperatures. Rainfall estimates are based on an empirical relationship between precipitation rate and fractional coverage by cold clouds derived from measurements taken during the CARPA Atlantic Tropical Experiment. between precipitation rate and tractional coverage by cold clouds derived from measurements taken during the GARP Atlantic Tropical Experiment. In addition, the diurnal variation of vertical motion, determined kinematically from level III-b gridded wind analyses of the European Centre for Medium Range Weather Forecasts, is examined. Principal conclusions are: 1) diurnal variation of deep convection occurred throughout the region of study; 2) the diurnal cycle varied considerably within the region of study, distinctly different convective regimes being found in five subregions; 3) the diurnal variation of inferred precipitation also differed from one subregion to another; and 4) vertical motions were upward relative to the mean at 2000 LST in the belt between 10 and 20 degrees N and downward in the South Pacific Convergence Zone and Intertropical Convergence Zone. (Main-PTT) W87-00307

RAIN AMOUNTS NEAR AND OVER NORTH BORNEO DURING WINTER MONEX, Massachusetts Inst. of Tech., Cambridge. S. G. Goetis, and R. A. Houze, Jr. Monthly Weather Review, Vol. 113, No. 10, p 1824-1828, October 1985. 2 fig, 9 ref. NSF Grant ATM 80-17327.

Descriptors: *Precipiation patterns, *Borne *Winter MONEX, *Monsoons, Radar, Rain gage

One of the objectives of the Global Atmospheric Research Programme's Winter Monsoon Experi-ment (Winter MONEX) was to determine the rain-fall amount over the South China Sea just north of IAII amount over the South China Sea just north of Borneo. Radar and rain gauge data were used to determine the precipitation pattern in the vicinity of the north coast of Borneo during Winter MONEX. The results show that separate maxima of rain occurred offshore and inland. Satellite data for other years suggest that this rainfall pattern typifies the winter monsoon in this area. (Main-PTT)

W87-00308

ATMOSPHERIC CIRCULATION CHANGES AIMOSPHEMIC CIRCULATION CHANGES ASSOCIATED WITH RAINFALL ANOMALIES OVER TROPICAL BRAZIL, National Environmental Satellite, Data, and Infor-mation Service, Washington, DC. Climate Analy-

Sis Center.
V. E. Kousky.
Monthly Weather Review, Vol. 113, No. 11, p
1951-1957, November 1985. 6 fig, 18 ref.

Descriptors: *Meteorology, *Atmospheric circula-tion, *Rainfall, *Brazil, Isotach patterns, Rainfall distribution, South America, North Atlantic Ocean, South Atlantic Ocean, Anticyclones, Trop-

During February and March 1981, contrasts exist-ed in the rainfall distribution over Brazil and in the atmospheric circulation over South America and the North and South Atlantic Oceans. Drier than atmospheric circulation over South America and the North and South Atlantic Oceans. Drier than normal conditions prevailed during February in the eastern and northeastern sections of Brazil, followed by an excessively wet March. The rainfall onset was associated with a low level equator-ward propagating convergence zone that originated as a cold front at higher latitudes in the Southern Hemisphere. During the period of stong convection, when observed rainfall rates in many areas exceeded 20 mm/d, a strong anticyclonic circulation developed in the upper troposphere to the west-southwest of the maximum rainfall rates. Another anticyclonic center developed north of the equator forming a couplet strikingly similar to the theoretical upper level flow pattern associated with a tropical heat source. The Northern Hemisphere midlatitude circulation changes over the Atlantic are similar to those associated with the recently studied 30-60 day oscillation, and to the North Atlantic Oscillation. (Main-PTT)

CLIMATOLOGY OF NONTORNADIC SEVERE THUNDERSTORM EVENTS IN THE UNITED STATES.

al Weather Service, Kansas City, MO. Cen

National Western Trail Region D. L. Kelly, J. T. Schaefer, and C. A. Doswell.

Monthly Weather Review, Vol. 113, No. 11, p
1997-2014, November 1985. 13 fig. 4 tab, 37 ref.

Descriptors: *Climatology, *Storms, *Severe thunderstorms, Tornadoes, Wind, Structural wind damage, Lightning, Precipitation.

The climatology of excessive rain and tornadoes is well-documented, but little is known of storms that produce high winds or large hail. The characteristics of the approximately 75,000 severe thunderstorms that occurred in the United States from storms that occurred in the United States from 1955 through 1983 are analyzed in an attempt to rectify this situation. The distribution of over 29,000 storms with hail larger than 19 mm shows marked diurnal, seasonal, and geographic preferences. These storms are most frequent during the midafternoon of May and June in a zone from central Texas to Nebraska. Spring storms tend to occur south of the Kansas-Nebraska border and summer storms north of it. Thunderstorm winds that cause structural damage or are reported as summer storms north of it. Thunderstorm winds that cause structural damage or are reported as faster than 25.8 m/s generated about 46,000 reports. These storms typically occur during midafernoon in June and July. While the geographic distribution of violent windstorms is similar to that of hallstorms, a zone of weaker severe thunderstorm gusts lies from northern lowa to central Ohio. During May, windstorms are predominant in the plains area, but by August these storms are indigenous only to the northern Midwest. (Main-PTT) W87-00310

USE OF PROBABILITIES IN SUBJECTIVE QUANTITATIVE PRECIPITATION FOR-CASTS: SOME EXPERIMENTAL RESULTS. Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.

pheric Sciences. A. H. Murphy, W-R Hsu, R. L. Winkler, and D. S.

Monthly Weather Review, Vol. 113, No. 12, p 2075-2089, December 1985. 4 fig, 5 tab, 30 ref. NSF Grants ATM-8004680, ATM-8209713.

Descriptors: *Probabilities, *Precipitation fore-casts, National Weather Service, Overforecasting,

This paper summarizes the results of an experiment in which National Weather Service forecasters formulated probabilistic quantitative precipitation forecasts (QPFs) during a 17-month period. These forecasts express the likelihood that certain threshold amounts of precipitation would be equaled or exceeded in 12-hour periods at four locations in Texas. The forecasters had no previous experience in quantifying the uncertainty in such forecasts, but they did receive feedback regarding their collective performance at the end of the first year of experiment. The subjective probabilistic QPFs possess positive skill, although they exhibit considerable overforecasting for larger precipitation amounts. Moreover, the feedback provided to the forecasters evidently contributed to modest increases in the reliability and skill of their forecasts. In this regard, the quality of the subjective and objective QPFs is generally comparable in the first year. However, after the receipt of the feedback, the skill of the objective forecasts. (Main-PTT) W87-00311

RELATIONSHIPS BETWEEN PRECIPITA-TION CHEMISTRY AND SOME METEORO-LOGICAL PARAMETERS IN THE NETHER-LANDS: A STATISTICAL EVALUATION,

Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science. For primary bibliographic entry see Field 5B. W87-00328

SOME EMPIRICAL EVIDENCE FOR THE IN-FLUENCE OF SNOW COVER ON TEMPERA-TURE AND PRECIPITATION,

Scripps Institution of Oceanography, La Jolla, CA.

Monthly Weather Review, Vol. 113, No. 9, p. 1542-1533, September 1985. 11 fig. 8 ref. NSF Grant ATM-8407891, National Climate Program Office Grant NASIAA-D-00054.

Descriptors: *Precipitation, *Snow cover, *Temperature, Air temperature, United States, Snow

The effect of snow cover or lack of snow cover on the surface temperature and precipitation in the coterminous United States during winter 1983/ 1984 was studied. Extensive snow occurred in the 1984 was studied. Extensive snow occurred in the eastern half of the country early in December 1983; this snow cover appears to have produced a substantial reduction in that observed surface temperature, especially during January 1984. This diminution was especially pronounced in the daytime maximum temperatures, presumably due to increased surface albedo. The effect involving anomalous snow cover also showed up in the Great Basin area during February 1984. A quantitative evaluation of the net effect of snow cover used errors of temperature specifications from 700 mb patterns formed from stepwise multiple regression equations. Temperature differences as great as 5 C were found over the temperatures expected from the large-scale circulation alone. The concomitant effect of increased static stability near the surface may have played a role in supressing precipitation over the midwest during the snow cover period. (Author's abstract) W87-00389

GLOBAL WATER VAPOR FLUX AND MAINTENANCE DURING FGGE,

Iowa State Univ., Ames. Dept. of Earth Sciences. T. C. Chen.

Monthly Weather Review, Vol. 113, No. 10, p 1801-1819, October 1985. 15 fig, 52 ref. NSF Grant ATM-8206798, NOAA Grant BA82AA-0-00035.

Precipitation—Group 2B

Descriptors: *Rainfall, *Precipitation, *Relative humidity, *Water vapor, Humidity, Temperature, Wind, Vapor transport, Global water vapor flux, Tropical regions.

Tropical regions.

The relative humidity, temperature and wind fields generated by the First Global GARP Experiment (FGGE) III-b analysis of the Geophysical Fluid Dynamics Laboratory (GFDL) were used to examine the global precipitable water distribution. The major water vapor content exists in tropical areas, especially over three regions: equatorial Africa, the northern part of South America, and equatorial western Pacific in December-February; equatorial disca, Central America and the northern part of South America, and monsoon areas in June-August. Water vapor transport was analyzed to explore how the high water vapor content of these areas is maintained by the large-scale atmospheric circulation. It is concluded that 1) the non-divergent stationary mode describes most of the atmospheric water vapor transport; 2) the stationary divergent modes, mainly the local Hadley and Walker circulations, are responsible for the local maintenance of the high water vapor content over three tropical areas; and 3) the divergent transient modes, essentially the cyclone systems, transport poleward an important portion of water vapor along the storm tracks in midlatitudes of both hemispheres and two major cloud bands in the Southern Hemisphere. (Author's abstract)

EXPERIMENTS IN PROBABILITY OF PRE-CIPITATION AMOUNT FORECASTING USING MODEL OUTPUT STATISTICS, Colorado State Univ., Fort Collins, Dept. of At-

mospheric Science.
R. W. Arritt, and W. M. Frank.
Monthly Weather Review, Vol. 113, No. 11, p
1837-1851, 5 fig, 6 tab, 22 re. Grant No. NSF 356-

Descriptors: *Precipitation, *Rainfall, *Forecasting, *Model studies, Precipitation forecasting, Precipitation rate, Prediction, Eastern United States, Equations, Seasonal variation.

Equations, Seasonal variation.

Modifications to current model output statistical procedures for quantitative precipitation forecasting were explored. Probability of precipitation amount equations were developed for warm and cool seasons in a region in the eastern United States. Twelve-term equations which were simultaneously regressed for four precipitation categories, were compared to equations that were regressed independently for each of the categories. The utilities of linear predictors not presently considered and of multiplicative predictors that were selected with the aid of a one parameter multiplicative model were investigated. All the forecast equations were evaluated using threat scores and biases achieved upon verification for one year of independent data. The independently regressed equations generally achieved threat scores similar to the twelve-term simultaneously regressed equations, and usually required fewer terms to do so. These more compact equations could be more readily interpreted by individual forecasters than could the twelve-term equations which made it easier to devlop techniques for local adjustments to the objective forecasts. (Author's abstract)

INTERESTING CLOUD FEATURES SEEN BY NOAA-6 3.7 MICROMETRE IMAGES, Oxford Univ. (England). Clarendon Lab. R. W. Saunders, and D. E. Gray. Metereological Magazine, Vol. 114, No. 1356, p 211-215, July 1985. 4 fig. 5 ref.

Descriptors: *Cloud cover, *Remote sensing, *Satellite images, British Isles, North Sea, Rainfall, Precipitation, Weather, Ice-water interfaces.

The appearance of clouds over the British Isles and North Sea at three wavelengths, visible and infra-red, is described for 3 July 1984. The daytime images show far more detail over clouds than the other two channels which are normally used for sting purposes. A cloud scattering radia

model is used to show the sensitivity of 3.7 micron radiances to water drop size and water/ice phase, and the nearest coincident synoptic chart is given for comparison with the satellite images. (Author's abstract)

LONG-RANGE FORECASTING OF TEMPERA-TURE AND PRECIPITATION WITH UPPER AIR PARAMETERS AND SEA SURFACE TEM-PERATURE IN A MULTIPLE REGRESSION APPROACH.

Missouri Univ.-Columbia. Dept. of Atmospheric

E. C. Kung, and H. Tanaka.

Meteorology Society of Japan Journal, Vol. 63, No. 4, p 619-631, August 1985. 11 fig, 4 tab, 12 ref. GARP Grant NSF ATM-8410487.

Descriptors: *Weather forecasting, *Temperature, *Precipitation, *Regressior. analysis, Upper air parameters, Sea surface temperature, Multiple regression approach, Multi-collinearity, Flow patterns, Circulation, Mathematical studies, Predictors, Predictors,

With a premise that the patterns of general circulation undergo continuous variation with time, experiments with a multiple regression scheme were conducted in the long-range forecasting of temperature and precipitation using upper air parameters and sea surface temperature for a period of twenty years beginning in 1963. The scheme used five predictors, effectively eliminating the problem of multi-collinearity. The scheme gave a lead time of predictors two to eleven months preceding predictands. The forecasting scheme was used to perform the regression analysis as an annual update procedure for the teleconnection of the large scale flow patterns. In forecasting experiments, the data from the forecast year are excluded from the data base. This ensures that the forecasting experiments are completely independent of the data of the forecast year. The experiments indicated that the predictands properly selected over various sizes of large areas of the United States, Canada and the USSR show considerable forecast skill. (Author's abstract) W87-00419

EFFECT OF SCREENING CHARGE TRANS-PORT ON ELECTRIFICATION AND PRECIPI-TATION PROCESSES IN THUNDERCLOUDS, Roorkee Univ. (India). Dept. of Physics. P. Singh, T. S. Verma, K. C. Mathpal, and N. C. Varshneya.

Varshneya. Meteorological Society of Japan Journal, Vol. 63, No. 4, p 673-683, August 1985. 4 fig, 2 tab, 44 ref.

Descriptors: *Precipitation, *Cloudbursts, Hydrometeors, Precipitation intensity, Fall velocity, Velocity, Particle size, Electric fields, Thunderclouds, Electrification, Charge transport, Particle colli-

The growth of hydrometeors along with electrical state and interaction among all categories of particles in thunderclouds, the effect of screening charge transport on electric fields, precipitation intensity, charge, size and fall velocity of hydrometeors, were analyzed. Screening charge transport increases the growth rates of electric fields and decreased the precipitation intensity. The calculations showed that thunderclouds containing low precipitation intensities can also generate high electric fields within appropriate time intervals. (Author's abstract) thor's abstract) W87-00420

CASE STUDY OF A HEAVY PRECIPITATION EVENT ALONG THE BAIU FRONT IN NORTHERN KYUSHU, 23 JULY 1982: NAGA-SAKI HEAVY RAINFALL, Illinois Univ. at Urbana-Champaign. Dept. of Atmospheric Sciences.

Illinois Univ. at Urbana-Champaign. Dept. of Atmospheric Sciences. Y. Ogura, T. Asai, and K. Dohi. Journal of the Meteorological Society Japan, Vol. 63, No. 5, p. 883-900, October 1985. 23 fig., 44 ref. NSF Grants ATM-8210130, ATM-8211786.

Descriptors: *Precipitation intensity, *Excess rainfall, Rainfall intensity, Japan, Nagasaki, Baiu front, Orographic storms

Orographic storms.

A 5 hr rainfall accumulation of 412 mm, at the city of Nagasaki, along the coastal area of Kyushu, Japan, is studied. Prior to the development of heavy precipitation, an intensive rainband was propagating with a speed of 40 km/hr east-southeastward over nortwestern Kyushu. A dramstic change occurred in the rainband when its southers tip reached the Nagasaki area; it stopped propagating and stayed there for the next 5 hr. The storm's line structure changed to a blob structure at the meso-beta scale (approx. 100 km), coinciding with the peak period of the incursion of very moist is associated with a southwesterly low-level jet. During heavy precipitation a new cloud cluster formed over the sea, 300 km west of Nagasaki. It kept developing and propagating eastward with a speed of 60 km/hr, and merged with the rainstorm over Nagasaki. These observations strongly suggest that the Nagasaki rainstorm was trapped orographically. Several other similar events are cited and discussed. (Master-PTT) W87-00425 W87-00425

STRUCTURE OF A TYPHOON RAINSTORM IN THE MIDDLE LATITUDES OBSERVED BY DOPPLER RADAR,

Meteorological Research Inst., Yatabe (Japan). H. Sakakibara, M. Ishihara, and Z. Yanagisawa Journal of the Meteorological Society of Japan, Vol. 63, No. 5, p 901-922, 15 fig, 1 tab, 23 ref,

Descriptors: *Rainfall intensity, *Excess rainfall, *Typhoons, Storms, Precipitation, Precipitation excess, Japan.

A rainstorm occurred over the central part of Japan within Typhoon 8124 (Gay) for 22-23 October 1981. The main purposes of the study were to clarify the structure of the rainstorm, and to know whether it was a typhoon spiral band or another type of precipitation system. Satellite and radar data show that this rainstorm occurred on the southeastern edge of a wide cloud band to the north of the typhoon center. A slant axis of strong wind from lower levels on the southeastern side to upper levels on the northwestern side was found by Doppler radar. This means the existence of a mesoscale alant updraft. Below the axis of the slantwise updraft, convective-scale vertical motion was generally small. The middle-level air intruded into the northwestern portion of the rainstorm in the southern part. The structure of the rainstorm in the southern part. The structure of the rainstorm was partially similar to those of a typhoon spiral band, eyewall clouds and a squall line in the middle latitudes. The result and interpretation of a mesoscale budget of condensed water in the form of precipitation particles are also shown to study the relative importance of production and transport of precipitation in the rainstorm. (Master-PTT) precipitation W87-00426

CONCENTRATIONS AND FLUXES OF TIN IN AEROSOLS AND RAIN, Florida State Univ., Tallahassee. Dept. of Ocean-

For primary bibliographic entry see Field 5B. W87-00458

ATMOSPHERIC DEPOSITION OF ORGANIC CARBON TO CHESAPEAKE BAY,

Old Dominion Univ., Norfolk, VA. Dept. of Mechanical Engineering and Mechanics.

For primary bibliographic entry see Field 5B. W87-00459

EFFECTS OF AIRBORNE PARTICULATE MATTER ON THE ACIDITY OF PRECIPITA-TION IN CENTRAL MISSOURI, Missouri Univ.-Columbia. Dept. of Geology. For primary bibliographic entry see Field 5B. W87-00460

Group 28-Precipitation

PRINCIPAL COMPONENT ANALYSIS OF TRACE SUBSTANCE CONCENTRATIONS IN RAINWATER SAMPLES, Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Hydrologie. For primary bibliographic entry see Field 5A W87-00461

FACTOR ANALYSIS OF THE MAP3S/RAINE PRECIPITATION CHEMISTRY NETWORK.

1976-1980, Governors State Univ., University Park, IL. Coll. of Arts and Scie

of Arts and Sciences.

J. Crawley, and H. Sievering.

Atmospheric Environment ATENBP, Vol. 20, No. 3, p 1001-1013, 1986. I fig. 3 tab, 20 ref.

Descriptors: *Chemistry of precipitation, *Factor analysis, *Network design, *Statistical models, *Multivariate analysis, *Acid rain, Seasonal variation, Regional analysis, Data collections, Sulfur, Nitrate, Ammonium sulfate, Hydrogen, Sodium, Potassium, Calcium, Magnesium, Hydrogen ion concentration, Dusts, Seawater.

A factor analysis of MAP3S/RAINE precipitation chemistry data for the period 1976-1980 was conducted to determine underlying sources and/or processes accounting for variance in the data. Three general sources, 'acid', sea, and 'ammonium' road dust/noil' account for most of the variance. Sulfate and nitrate are significant components of the acid factor. Seasonal and spatial analyses show a sunamer maximum in contribution of the acid factor, and individual site results indicate that this contribution increases in going from the midwest to the northeast. Seasonal results show the 'ammonium' soil' appearing in spring and sunamer while an ammonium sulfate factor appears in fall and winter. This study is intended to serve as a baseline for comparing factor analyses of subsequent for comparing factor analyses of subsequent MAP3S data sets and northeastern U.S. precipitation chemistry networks. (Author's abstract) W87-00462

MASS TRANSFER FROM WATER DROPLETS UNDER SIMULATED FREE FALL CONDI-

Colorado State Univ., Fort Collins. Dept. of Civil For primary bibliographic entry see Field 5B. W87-00464

RANK CORRELATION FOR SCREENING PRECIPITATION CHEMISTRY DATA, Pennsylvania State Univ., University Park. School of Forest Resources. For primary bibliographic entry see Field 7A. W87-00465

SIGNIFICANCE OF SYSTEMATIC ERROR IN RAINFALL MEASUREMENT FOR ASSESSING WEST DEPOSITION, Institute of Hydrology, Wallingford (England). Por primary bibliographic entry see Field 5B. W87-00467

RELATIONSHIPS BETWEEN CLIMATE AND RELATIVE PERFORMANCE OF COTTON IN

NEW SOUTH WALES, Commonwealth Scientific and Industrial Research Organization, Narrabri (Australia). Div. of Plant Industry. Industry. N. J. Thomson.

Australian Journal of Agricultural Research, Vol. 37, No. 1, p 23-30, 1986, 4 fig, 5 tab, 6 ref.

Descriptors: *Climates, *Cotton, *New South Wales, Rainfall, Temperature, Crop production, Seasonal variation, Statistical analysis, Regression analysis, Cultivation.

Cumulative day-degrees, total rainfall and the mean daily values for evaporation rate, maximum temperature, minimum temperature and radiation for a period of 200 days from 1 October to 18 April were used to characterize the climates of cotton-growing seasons at Narrabri (30 degrees S.),

N.S.W. Yields (expressed as percentages of standards) of some cultivars included in field trials in cotton-growing districts of New South Wales, were then regressed on these climatic indices. In a number of cases strong, significant linear associations of performance with one or more of the indices were found. Such cultivars were either more or less advantaged by warm, dry conditions than the standards, and vice versa for cool, wet conditions. The implications of these results in studies of genotype x environmental interaction are discussed. (Author's abstract)

RESULTS OF SEEDING FOR DYNAMIC EFFECTS ON RAIN-CELL PROPERTIES IN FACE-2, Hebrew Univ., Jerusalem (Israel). Dept. of Atmospheric Sciences. For primary bibliographic entry see Field 3B. W87-00579

HAIL IN SOUTHWESTERN FRANCE. I: HAIL-FALL CHARACTERISTICS AND HAILSTORM ENVIRONMENT,

Clermont-Ferrand-2 Univ., Lann Center of Atmospheric Research. J. De

Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 1, p 35-47, January 1986. 19 fig, 5 tab, 35 ref.

Descriptors: "Hail, "France, "Crop insurance, "Thunderstorms, "Statistical analysis, "Weather patterns, Geography, Winds.

patterns, Geography, Winds.

Geographical distribution of hail damage; yearly, 5-day, and hourly frequencies of hailfall; and the distributions of hailstone size and of hailfall duration were determined for the Aquitaine region, France, based on 12869 reports of damaging hail compiled over 29 years and crop insurance data for this 88980-sq km area. Most of the data are explained well by the fact that hailfall in the region is the result of of almost any rather severe thunderstorm. Large hail, however, is produced by a few isolated long-lived hailstorms traveling downwind of the central part of the Pyrenees with the strong upper level winds. Study of the mean characteristics of 30 of the most severe storms that have damaged the Aquitaine in the last 3 decades resulted in the following description: a typical long-traveling hailstorm moves at 15 m/s for 1.5 hr, dropping a hail strip 86 km long and 6 km wide. The direction of propagation is from the southwest, with an angular deviation of 28 deg to the right of the mean tropospheric wind. This wind is characterised by an increase in redictive to 10. right of the mean tropospheric wind. This wind is characterized by an increase in velocity up to 10 km (mean maximum: 32.6 m/s) without any in direction above 3 km. In some circum these long-traveling hallstorms produce only hall-spots along their path, although the convective and wind conditions are the same as for the major hallstorms. (See also W87-00581) (Author's abstract) W87-00580

HAIL IN SOUTHWESTERN FRANCE, II: RE-SULTS OF A 30-YEAR HAIL PREVENTION PROJECT WITH SILVER IODIDE SEEDING

FROM THE GROUND, Clermont-Ferrand-2 Univ., Lann Center of Atmospheric Research.

JOURNAI of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 1, p 48-58, January 1986. 7 fig, 4 tab, 28 ref, 1 append.

Descriptors: *Hail, *France, *Crop damage, *Statistical analysis, *Weather patterns, *Weather modification, *Cloud seeding, Silver iodide, Cost analysis, Geography.

A nonrandomized weather modification project, hail seeding from the ground, has been run since 1952 in southwestern France. Seeding efficiency in the area covered by AgI ground generators was the loss-to-risk ratio derived from insurance data. A relative decrease in this parameter was observed over the last 15 years in the protected area. A new

statistical test for detecting a shift in precipitation series, applied after a log-transformation to the loss-to-risk ratio series, indicated a decrease significant at the 0.01 level in damage due to hail during the period 1965-1982 in the protected area, whereas no significant change was observed in the buffer area. A double-ratio calculation with the target and control area data gives a value of 41% for the decrease in damage in the seeded area. The benefit/cost ratio of the project appears to about 24. Physical implications of the hail-prevention results are discussed. (See Also W87-00580) (Rochester-PTT) W87-00581

SENSITIVITY OF THE PALMER DROUGHT SEVERITY INDEX AND PALMER'S Z-INDEX TO THEIR CALIBRATION COEFFICIENTS IN-CLUDING POTENTIAL EVAPOTRANSPIRA-

TION, National Climatic Center, Asheville, NC. T. R. Karl.

Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 1, p 77-86, January 1986. 6 fig, 2 tab, 14 ref.

Descriptors: *Palmer Drought Severity Index, *Palmer Z-index, *Calibration coefficients, *Drought, *Evapotranspiration, *Climatic data, *Water deficit, Forestry, Agriculture, Statistics, Moisture anomalies.

By changing the base period used to calibrate the coefficients of the Palmer Drought Severity Index (PDSI) from the traditionally employed 1931-60, which was anomalously hot and dry, the magnitude and sign of the PDSI change significantly for many areas in the United States. Often the changes are larger than those that occur when the potential evapotranspiration is forced to a constant equal to the long-term monthly mean potential evapotranspiration. The less frequently used Palmer moisture anomaly index (Z-index) is much less sensitive to changes in the calibration periods, and also has some desirable characteristics that may make it preferable to the PDSI for some agricultural and forest fire applications, ie, it is more responsive to short-term moisture anomalies. The Z-index is recommended over the PDSI or the Palmer Hydrological Drought Index for assessing short-term moisture deficiencies. (Rochester-PTT)

EXPERIMENTAL STUDIES IN NATURAL GROUNDWATER-RECHARGE DYNAMICS: THE ANALYSIS OF OBSERVED RECHARGE

Kansas State Geological Survey, Lawrence. For primary bibliographic entry see Field 2F. W87-00585

COMPUTER SIMULATION OF WATER DROP IMPACT IN A 9.6-MM DEEP POOL, California Univ., Davis. Dept. of Land, Air and Water Resources.

N. G. Ferreira, B. E. Larock, and M. J. Singer. Soil Science Society of America Journal SSSJD4, Vol. 49, No. 6, p 1502-1507, November-December 1985. 10 fig. 1 tab, 10 ref.

Descriptors: *Fluid drops, *Soil surfaces, *Sus-pended sediments, *Sediments, *Simulation analy-sis, Navier-Stokes equation, Continuity equation, Velocity field, Crater development, Rayleigh jet, Rainfall.

The interaction between rainfall and shallow over-The interaction between rainfall and shallow over-land flow causes an increase in sediment yield over that produced by either process alone. One way to understand this phenomenon is to study the phys-ics of waterdrop impact on a water layer that overlies a hard surface. The interaction between impact of a 3.2-mm drop and a water layer over the soil surface was studied by simulating drop impact through the solution of the Navier-Stokes and continuity equations for a viscous and incom-pressible field on an Euierian grid, using a finite difference method. The simulation was validated by experiments. The velocity field produced by the

Snow, Ice, and Frost-Group 2C

simulation showed a reversal of the velocity vectors at the time of maximum crater development, followed by crater collapse and formation of the Rayleigh jet. A comparison of measured and simulated crater and crown development ahowed good agreement. The energy balance from the computer simulation showed that the shear energy development along the bottom of the pool reached a maximum value during the crater collapse when the velocity vectors in the corresponding velocity field were pointing inwards and upwards. The effects of the water layer over the surface are to provide a medium where the soil material can be suspended and transported away, and to allow the reversal of the velocity field with the lifting and suspension of the soil material. (Peters-PTT)

ENERGY DISSIPATION FOR WATER DROP IMPACT INTO SHALLOW POOLS, California Univ., Davis. Dept. of Land, Air and Water Resources. For primary bibliographic entry see Field 2J. W87-00609

CHEMISTRY AND MICROPHYSICS OF INTRASTORM SEQUENTIAL PRECIPITATION SAMPLES,

SAMPLES, State Univ. of New York at Albany. Atmospheric Sciences Research Center. R. Castill, G. Lala, and J. E. Jiusto. Tellus TELLAL, Vol. 37B, No. 3, p 160-165, July 1985. 4 fig. 10 ref. Grants NOAA NA2RAC00074, DAAG 2981 K0019, NSF 320-

Descriptors: "Acid rain, "Water chemistry, "Hydrogen ion concentration, "Chemical analysis, "Rainstorms, "Precipitation, New York, Albany, Droplet size, Particle measuring systems, Acidity, Precipitation rate.

A slow-moving cold front, progressing across New York State from west to east for 2 days, November 4 and 5, 1982, prior to arrival at the Albany County Airport, New York, which deposited over 40 mm of rain, was investigated for relationships between pH, ion concentrations and precipitation microphysics. For the first time, precipitation droplet size spectra were available using a Particle Measuring System's ground-based precipitation probe. The precipitation spectra allowed a preliminary analysis of below cloud rain scavenging: adsorption and impaction. The cumulative rate of chemical precipitation versus cumulative water indicated two different slopes for the major ions contributing to the acidity of the precipitation. The slopes were consistent with a convective stage and a non-convective storm stage and this was consistent with rate of precipitation. (Peters-PTT)

TROPICAL ATLANTIC SEA SURFACE TEM-PERATURES AND RAINFALL VARIATIONS IN SUBSAHARAN AFRICA, Arizona Univ., Tucson. Lab. of Tree-Ring Re-

Search.
J. M. Lough.
Monthly Weather Review MRWEAB, Vol. 114,
No. 3, p 561-570, March 1986. 8 fig, 2 tab, 30 ref.

Descriptors: *Rainfall, *Africa, *Rainfall intensity, *Seawater, Precipitation, Temperature, Atlantic Ocean, Semiarid lands, Atmospheric pressure.

The most important patterns of normalized sea surface temperature (SST) departures in the tropical Atlantic are identified using principal component analysis. The first three eigenvectors of separate monthly and seasonal analyses over the period 1948 to 1972 produce similar patterns of SST variation. In addition, the first three monthly eigenvectors are shown to occur with equal frequency during the earlier part of this century from 1911 to 1939. The second eigenvectors of monthly and seasonal SST departures are significantly correlated with normalized sea level pressure (SLP) departures (also specified using principal component analysis) over the period 1948 to 1972. On monthly times scales, the strongest relationship is found

with the SLP field leading the SST field by one month. The second SST eigenvectors are also shown to be significantly correlated with Sahel rainfall variations over the period 1948 to 1972. The SST-rainfall relationship for this recent period appears to be different from that of the early 20th century, when no significant correlation is found. This finding may have resulted from different causes of wet and dry years in the Sahel during the two time periods considered here. (Author's abstract) W87-00729

GENERALIZED PARETO DISTRIBUTION AP-PLIED TO RAINFALL DEPTHS, Agricultural Univ., Wageningen (Netherlands). Dept. of Mathematics. M. A. J. Van Montfort, and J. V. Witter. Hydrological Sciences Journal HSJODN, Vol. 31, No. 2, p 151-162, June, 1986. 5 fig, 2 tab, 11 ref.

Descriptors: *Rainfall intensity, *Pareto distribtion, *Distribution analysis, Rainfall, Mathematic studies, Statistical methods, Statistical analysi Annual distribution.

Annual distribution.

The Generalized Pareto distribution is fitted to Dutch peaks-over-threshold (POT) rainfall series. Maximum likelihood (ML) estimation of the parameters is discussed, with particular reference to bias reduction for the scale and shape parameter. The improvement of the fit in the right tail by left censoring of POT series is discussed, and the dependence of the shape parameter theta of the fitted Generalized Pareto distribution on (a) mean annual number of peaks, and (b) rainfall duration, with fixed or moving starting point, is quantified. The Generalized Pareto distribution is quite applicable to POT series of rainfall depth. Probability plots of such series, when based on hourly rainfall, generally are smoothly curved upward, indicating the plausibility of the Generalized Pareto distribution (with negative theta) as a compound distribution. However, some POT series of daily rainfall show exponentially-distributed peaks, with one or more outlying observations. In these applications, bias in the parameter estimates is negligible. The fit of the Generalized Pareto distribution to the right tail of the POT series can be improved by left censoring. (Doria-PTT) W87-00772. (Doria-PTT) W87-00772

REVIEW OF THE FACTORS AFFECTING THE DEVELOPMENT OF GHYBEN-HERTZBERG LENSES IN THE BAHAMAS, Ministry of Works and Utilities, Nassau (The Bahamas). Family Ialand Div. For primary bibliographic entry see Field 2F. W87-00818

2C. Snow, Ice, and Frost

SNOWPACK AUGMENTATION RESEARCH NEEDS: A HISTORY OF WEATHER MODIFI-CATION IN COLORADO, Colorado Dept. of Natural Resources, Denver. Weather Modification Program. For primary bibliographic entry see Field 3B. W87-00070

TEMPORAL AND SPATIAL VARIATION OF SNOW PRESSURE ON STRUCTURES, Norges Geotekniske Inst., Oalo.
J. O. Larsen, D. M. McClung, and S. B. Hansen.
Canadian Geotechnical Journal CGJOAH, Vol.
22, No. 2, p 166-171, May 1985. 10 fig, 1 tab, 6 ref.

Descriptors: *Snow pressure, *Temporal variations, *Spatial variations, *Norway, *Snow creep, Slope inclination, Snowpack parameters.

Snow creep pressures are an important consideration in the design of structures placed on mountainsides subjected to deep snow cover. Prediction of pressures exerted at the center section of a long supporting structure is needed such that edge effects may be ignored. Measurements of snow creep pressure on an avalanche-defence structure in

western Norway were presented. Two different types of measurement methods were described. Pressure data from four winters were correlated with anowpack properties like density, snow depth, anowpack stiffness. The results showed that the maximum and average pressures were strongly dependent on the product of density and snow depth as well as snowpack stiffness. The highest pressures were observed in spring prior to melting of the snowpack. (Khumbatta-PIT) W87-0027

VEGETATION AND FLORA ASSOCIATED WITH LOCALIZED SNOW ACCUMULATION AT MOUNT FIELD WEST, TASMANIA, Tasmania Univ., Hobart (Australia). Dept. of Botany. For primary bibliographic entry see Field 2I. W87-00353

ADAPTATION OF AQUATIC MICROBIAL COMMUNITIES TO QUATERNARY AMMO-NIUM COMPOUNDS, For primary bibliographic entry see Field 5C. W87-00361

TWENTIETH CENTURY TRENDS IN ARCTIC AIR POLLUTION REVEALED BY CONDUC-TIVITY AND ACIDITY OBSERVATIONS IN SNOW AND ICE IN THE CANADIAN HIGH For primary bibliographic entry see Field 5B. W87-00366

ATMOSPHERIC TRANSPORT AND DEPOSI-TION OF TRACE ELEMENTS ONTO THE GREENLAND ICE SHEET, Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering. For primary bibliographic entry see Field 5B. W87-00367

WINTER ICE REGIME IN THE TIDAL ESTU-ARIES OF THE NORTHEASTERN PORTION OF THE BAY OF FUNDY, NEW BRUNSWICK, New Brunswick Univ., Fredericton. Dept. of Civil New Brunsw Engineering For primary bibliographic entry see Field 2L. W87-00440

ST. LAWRENCE RIVER FREEZE-UP FORE-CAST,
Cold Regions Research and Engineering Lab.,
Hanover, NH.
E. P. Foltyn, and H. T. Shen.
Journal of Waterway, Port, Coastal and Ocean
Engineering JWPED5, Vol. 112, No. 4, p 467-487,
July 1986. 7 fig. 6 tab, 16 ref. DOC Grant No.
NA81AAD-00027.

Descriptors: *St. Lawrence River, *River forecasting, *Ice formation, *Computer models, Air temperature, Water temperature, Flow velocity, Heat transfer.

A method for long-range forecasting of freeze-up dates for rivers is developed. The method uses initial water temperature at an upstream station, long-range forecast of air temperature, the predicted mean flow velocity in the river reach and water temperature response parameters that are either estimated from the surface heat exchange coefficient and average flow depth or determined empirically from recorded air and water temperature data. The method is applied to the St. Lawrence River for forecasting the freeze-up date. (Michael-PTT) PIT W87-00496

HAIL IN SOUTHWESTERN FRANCE, I: HAIL-FALL CHARACTERISTICS AND HAILSTORM ENVIRONMENT, rmont-Ferrand-2 Univ., Lannuter of Atmospheric Research.

Group 2C-Snow, Ice, and Frost

For primary bibliographic entry see Field 2B. W87-00380

HAIL IN SOUTHWESTERN FRANCE. II: RE-SULTS OF A 30-YEAR HAIL PREVENTION PROJECT WITH SILVER IODIDE SEEDING FROM THE GROUND, Clermont-Ferrand-2 Univ., Lannemezan (France). Center of Atmospheric Research. For primary bibliographic entry see Field 2B. W87-00581

HYPOTHESIS-TESTING BY MODELLING CATCHMENT RESPONSE, II. AN IMPROVED

MODEL, Hull Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2E. W87-00587

SEPARATION OF A SNOWMELT HYDRO-GRAPH BY STREAM CONDUCTANCE, For primary bibliographic entry see Field 2E. W87-00639

PARAMETER VALUES FOR SNOWMELT RUNOFF MODELLING, Eidgenoessisches Inst. fuer Schnee- und Lawinen-forschung, Davos (Switzerland). For primary bibliographic entry see Field 2E. W87-00810

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION IN HUMID TROPI-

CAL REGIONS, Royal Netherlands Meteorological Inst., De Bilt. H. A. R. de Bruin

H. A. R. de Bruin.
In: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p
299-311, 3 fig, 40 ref, 1 append.

Descriptors: *Evapotranspiration, *Tropical regions, *Evapotranspiration potential, Climatological data, Peannan-Monteith equation, Transpiration, Priestley-Taylor method, Mathematical studies, Rainfall, Drought.

The large-scale features of evapotranspiration (ET) in the humid tropics are discussed as well as methods for the estimation of potential ET (PET). A simple method, requiring the duration of sunshine only, was tested, using climatological data for several sessions. The several sessions are ons for the estimation of potential E1 (PE1). A simple method, requiring the duration of sunshine only, was tested, using climatological data for several stations. The results are summarized as follows: (a) For research purposes and diagnostic studies the Penman-Monteith equation is the most appropriate for the determination of E1; (b) In the wet season it is to be expected that ET reaches its potential rate, and approaches the water equivalent of net radiation; (c) Under conditions where on the average neither the interception nor the transpiration dominates ET, the 'old' Penman formula provides a reasonable estimate of PET for a reference green grass cover; (d) Evidence is presented for the validity of the Priestley-Taylor method. Although the P-T parameter alpha is not a universal constant, a value of 1.26 for alpha also appears to be an appropriate working hypothesis for the tropics; (e) In the wet season a simplified Priestley-Taylor formula appears to be a suitable substitute for the 'old' Penman equation. A verification of this is presented for about 60 tropical stations which are less than 600 m in altitude; (f) In the dry season evaporation is much more variable. The complementary approach for estimating ET under nonpotential conditions requires further refinements; (g) For stations with a long wet season (more than seven months) the annual ET (AET) is found to be primarily determined by the duration of sunshine; and, (h) For stations with a very pronounced dry season (less than 100 mm of rainfall in the four driest months) AET depends to a great extent on the duration of that dry season. (See also W87-0016) (Lantz-PTT)

SOYBEAN LEAFLET MOVEMENTS AS AN IN-DICATOR OF CROP WATER STRESS, Arkansas Univ., Fayetteville. Dept. of Agronomy. D. M. Oosterhuis, S. Walker, and J. Eastham. Crop Science CRPSAY, Vol. 25, No. 6, p 1101-1106, November/December 1985. 6 fig. 1 tab, 27

Descriptors: *Irrigation requirements, *Plant physiology, *Moisture stress, *Water shortage, Stomata, Osmosis, Diffusivity, Leaves, Water potential, Turgor, Potassium, Soil moisture deficiency, Soybeans,

A field study was conducted to quantify the movements of soybean leaflets and to investigate the usefulness of this phenomenon as an indicator of crop water stress by comparing leaflet movements with changes in components of leaf water potential, stomatal diffusive resistance and soil water depletion. The physiological mechanism of changes in osmotic and turgor potentials and potensium concentration across the pulvinus was also investigated. It is concluded that observation and measurement of upper canopy leaf angles could be used as an indicator of the onset of crop water stress for irrigation scheduling purposes. (Michael-PTT) PTT) W87-00341

CONTROL OF NA(+) AND K(+) TRANSPORT IN SPERGULARIA MARINA: IL EFFECTS OF PLANT SIZE, TISSUE ION CONTENTS AND ROOT-SHOOT RATIO AT MODERATE SALIN-

ITY, Illinois Univ. at Urbana-Champaign. Dept. of Plant Biology.

For primary bibliographic entry see Field 2I. W87-00554

SENSITIVITY OF THE PALMER DROUGHT SEVERITY INDEX AND PALMER'S Z-INDEX TO THEIR CALIBRATION COEFFICIENTS IN-CLUDING POTENTIAL EVAPOTRANSPIRA-TION, National Climatic Center, Asheville, NC. For primary bibliographic entry see Field 2B. W87-00582

WIND FUNCTION FOR A SHELTERED STREAM, Minnesota Univ., Minneapolis. St. Anthony Falls

Hydraulic Lab.
J. S. Gulliver, and H. G. Stefan.
Journal of Environmental Engineering (ASCE)
JOEEDU, Vol. 112, No. 2, p 387-399, April 1986.
6 fig. 1 tab, 18 ref. EPA Grant R80368601.

Descriptors: *Convection, *Wind, *Temperature effects, *Minnesota, Environmental Protection Agency, Duluth, Streams, Nuclear power plants, Northern States Power Company, Sheltered streams, Mississippi River, Channels, Flow rates, Natural convection, Forced convection.

Natural convection, Forced convection.

Wind functions were back-calculated from 47 cases of near steady-state longitudinal temperature profiles in a sheltered stream. The Monticello Ecological Research Station, a branch of the U.S. Environmental Protection Agency's Environmental Research Laboratory in Duluth, Minnesota, is located approximately 40 miles northwest of Minnespolis near Monticello, Minnesota, on 34 acres adjacent to a nuclear power generating plant owned and operated by Northern States Power Co. There are 8 soil bottom experimental open channels of approximately 520 m length each. The Mississippi River serves as the main source of water for the channels which operate in a once-through mode. Flow rates in each channel are controlled and metered. V-notch weirs are installed at the head of each channel. Wind speed, air temperature, and relative humidity were continuously measured. Water temperature was artificially elevated; thus, natural convection was significant. Four formulations were fit to the measurements with roughly equal results. The natural convection term in the formulation by Ryan and Harleman was virtually duplicated by the sheltered stream, while the forced convection term was lower for the sheltered stream. (Peters-PTT)

W87-00600

EVAPORATION RATE FROM A SALT PAN: ESTIMATES FROM CHEMICAL PROFILES IN NEAR-SURFACE GROUNDWATERS,

Australian National Univ., Canberra. Rese School of Earth Sciences.

Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 365-373, July 30, 1985. 3 fig. 22 ref.

Descriptors: *Evaporation rate, *Salt pans, *Chemical properties, *Australia, *Groundwater, *Model studies, Evaporation, Pan evaporation, So-

Evaporation of water from saturated saline soils or sediments induces gradients of the solutes in the remaining interstitial solution. These gradients lead to a systematic and predictable solute distribution in the soil solution which may be used, in some cases, to estimate the rate of evaporation. Two techniques were used to estimate the evaporation rate through a salt (halite) crust on a playa surface at Lake Eyre, South Australia. One technique uses the distribution of chloride ion in the intersittial waters below the salt surface, and the second exploits the exclusion of bromide ion from the crystal structure of halite in the course of halite precipitation at the playa surface. Simple one-dimensional transport models for the distribution of chloride and bromide indicate net evaporation rates from the salt-covered surface of Lake Eyre of between 0.9 and 2.8 cm per year; the former is a minimum estimate averaged over approximately 20 years (which includes the major 1974 filling event) while the latter reflects the most recent summer evaporation period. (Doria-PTT) W87-00786

INVESTIGATION INTO THE USE OF DEUTE-RIUM AS A TRACER FOR MEASURING TRANSPIRATION FROM EUCALYPIS, IRANSFIRATION FROM EUCLAL FIRST Institute of Hydrology, Wallingford (England). I. R. Calder, M. N. Narayanswamy, N. V. Srinivasalu, W. C. Darling, and A. J. Lardner. Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 345-351, May 30, 1986. 1 fig, 1 tab, 21 ref.

Descriptors: *Deuterium oxide, *Radioactive tracers, *Isotope studies, *Eucalyptus teretocornis, *Transpiration, India, Coefficent of variation, Diferential equations, Eucalypts, Trees, Plant water relations, Plant physiology, Mathematical analysis.

reiations, Plant physiology, Mathematical analysis. The use of deuterium oxide (D2O) as a tracer for measuring transpiration rates was investigated on 3-yr-old Eucalyptus teretocornis trees growing in southern India. Two trees, of 4.9 cm diameter, were injected with 3.0 and 1.5 ml of D2O, respectively. Four samples of transpired water were collected per tree as condensate in plastic bags enclosing branches at the top and bottom of the canopy. The coefficient of variation of the integral of the concentration-time curves (/Cdt) from the four sampling positions on each tree was 11 and 15%, respectively. Unlike another reported study, /Cdt was found to be larger (on average by 25 + or -7%) from samples taken at the top of the canopy compared with those from the bottom. Transpiration rates were calculated as 0.86 + or -0.05 and 0.85 + or -0.07 mm per day from the two trees. The internal consistency of the results suggests that the method is well suited to transpiration studies from young eucalypts. (Author's abstract) W87-00819

2E. Streamflow and Runoff

FLOODS ON RICHLAND CREEK, LITTLE RICHLAND CREEK, BROYLES BRANCH, AND AN UNNAMED TRIBUTARY TO BROYLES BRANCH IN DAYTON, TENNES-SEE, AND VICINITY.

Tennessee Valley Authority, Knoxville. Office of Economic and Community Development. For primary bibliographic entry see Field 4A. W87-00004

Streamflow and Runoff-Group 2E

RUNOFF AND FLOOD CHARACTERISTICS IN SOME HUMID TROPICAL REGIONS, National Research Center for Disaster Prevention, Sakura (Japan). For primary bibliographic entry see Field 2A. W87-00089

HYDROLOGICAL CHARACTERISTICS OF THE CARIBBEAN, For primary bibliographic entry see Field 2A. W87-00091

EVALUATION OF RUNOFF SOURCES IN A PORESTED BASIN IN A WET MONSOONAL ENVIRONMENT: A COMBINED HYDROLOGICAL AND HYDROCHEMICAL APPROACH, Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
L. A. Bruijnzee.
IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 165-174, 4 fig. 21 ref. Project No. W76-45.

Descriptors: "Storm runoff, "River basins, "Forests, "Monsoons, "Hydrological regime, "Hydrochemical aspects, Java, Indonesia, Channel precipitation, Overland flow, Storm seepage, Groundwater movement, Hydrographs, Tropical regions.

er movement, Hydrographa, Tropical regions.

A semiquantitative description of stormflow producing mechanisms is given for a forested basin in central Java, Indonesia. Storm runoff events, consisting of a mixture of channel precipitation, Horton overland flow, saturation overland flow and subsurface flow were studied in terms of contributing areas. Occurrence and importance of the various flow types are tentatively evaluated on a lumped basis per storm by combining field observations and the concept of 'minimum contributing area'. Description of subsurface stormflow behavior during storms became possible to some extent by detailed water quality sampling. Subsurface flow contributes to total quickflow throughout storms via the mechanism of displacement flow, becoming dominant during the later stages of the storm hydrograph. It is concluded that the variable source area concept is applicable to this tropical basin. (See also W87-00086) (Author's abstract) W87-00098

LACK OF DEPENDENCE OF LOSSES FROM FLOOD RUNOFF ON SOIL AND COVER CHARACTERISTICS, New South Wales Univ., Kensington (Australia). School of Civil Engineering. I. Cordery, and D. H. Pilgrim.
IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 187-195, 2 fig, 2 tab, 13 ref.

Descriptors: "Water loss, "Surface runof "Floods, "Soil properties, Basins, Flood basin Interception loss, Infiltration, Depression storag Rainfall-runoff relationships, Australia.

Most manuals of agricultural and engineering design practice published in the last 50 years embody the assumption that soil and vegetation characteristics are major determinants of flood runoff. This assumption may be true for minor floods from small homogeneous areas, and for deep forest soils in temperate regions, especially during high infiltration early in a storm. However, for basins in many regions this assumption is probably not true and data are presented indicating the independence of storm continuing loss rates and soil and cover type for about 50 basins throughout Australia. These basins are located in various agricultural and forested regions in the humid zone, with one in the arid zone. Data collected in New Zealand and USA support these findings. Loss rate data from 53 basins ranging in size from 5 ha to 15,000 sq km have been collected and analyzed to determine whether they are related to such basin

characteristics as size or soil and vegetation types. It has been shown that the median loss rates are not dependent on any of these basin characteristics but vary, apparently randomly, within a fairly narrow band. The variation of loss rate values but vary, apparently randomly, within a fairly narrow band. The variation of loss rate values derived from any one basin is quite large, but there is a significant difference between values from different basins which indicates that the values are not all drawn from a single population. This means that for estimating large floods the use of design loss rate values which vary from basin to basin depending on the soil and/or vegetation characteristics is not justified and the adoption of a single, low value for a whole region may be more appropriate. These conclusions may not apply to basins in the temperate zone, and investigation of data from a large range of these basins would be required before the conclusions of this study could be extrapolated to the temperate zone. (See also W87-00086) (Lantz-PTT)

RUNUFF GENERATION IN TROPICAL RAIN-FORESTS OF NORTHEAST QUEENSLAND, AUSTRALIA, AND THE IMPLICATIONS FOR LAND USE MANAGEMENT, James Cook Univ. of North Queensland, Towns-ville (Australia). Dept. of Geography. For primary bibliographic entry see Field 4C. W87-00109 RUNOFF GENERATION IN TROPICAL RAIN-

HYDROLOGICAL STUDIES OF THE IRRAWADDY DELTA, Halcrow (William) and Partners, Swindon (Eng-

land).
J. S. A. Brichieri-Columbi.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg. West Germany, August 15-27, 1983. p
353-364, 2 fig, 3 ref.

Descriptors: *Hydrology, *Irrawaddy Delt *Mathematical models, *Surveys, Drainage basin Deltas, Hydrologic regime, Short-term plannin Available water, Mali River, N'Mai River, Burm China.

Available water, Mali River, N'Mai River, Burma, China.

The Irrawaddy is formed by the confluence of the Mali and N'Mai rivers which rise among 6,000 m peaks on the Burma-China border, and drains a 415,000 sq km drainage basin. As it is navigable for much of its 2,000 km length, and provides a constant supply of fresh water to the dry central zone, it has played a dominant role in the history and economic life of Burma. The delta starts at Kyangin, 380 km from the Gulf of Martaban, at an altitude of 15 m, and extends over an area of 31,000 sq km between the confining hills of the 1,300 m Arakan Yomas in the west and the 900 Pegu Yomas in the east. The river fans out from its braided channel above Kyangin in a complex of tidal creeks which drain into the gulf by 12 major mouths extending over 260 km of coast. In the period November 1977-March 1981, a hydrological survey was carried out by various British government and private organizations under a project funded by the IDA and ODA (UK). The study objectives were (a) to establish hydrological design parameters for paddy projects; (b) to determine the availability of fresh water in the lower delta channels; (c) to assess the effect of short-term projects for development of 400,000 ha of paddyland, and long-term development with widespread embanking, on the hydraulic regime of the delta. To satisfy the second and third objectives, a one-dimensional mathematical model of the delta was set up to study the fluvio-tidal interaction under low flow and flood conditions. The modelling work was carried out in parallel with a major survey effort in order to concentrate the survey of ficiently, and to identify errors in the survey or modelling while the teams were still available. (See also W87-00086) (Lantz-PTT)

EFFECTS OF METEOROLOGICAL INPUTS ON THE VARIABILITY OF RUNOFF WITH TIME,

Belgrade Univ. (Yugoslavia). Faculty of Agricul-For primary bibliographic entry see Field 2A.

OPTIMAL FLOOD CONTROL POLICY BASED ON IMPERFECT FORECASTS, Delhi Coll. of Engineering (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6F.
W87-00119

RIVER FLOW FORECASTING THROUGH A REGRESSION MODEL: A CASE STUDY OF THE BASEMENT COMPLEX OF WESTERN

NIGERIA, Lagos Univ. (Nigeria). Dept. of Civil Engineering. E. S. Oyegoke, E. D. Ige, and L. Oyebande. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Sym-posium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 419-426, 1 fig, 3 tab, 4 ref.

Descriptors: "River flow, "Regression analysis, *Statistical models, "Nigeria, Flow measurement, River forecasting, Hydrologic data, Hydrologic models, River basins, Ogun River, Oahun River, Shasha River, Owena River.

Shasha River, Owena River.

The area of study is predominantly the Basement Complex region of western Nigeria, drained by a system of rivers communicating with the sea through a system of lagoons and creeks that characterize the coastal region of West Africa. The Basement Complex, a geological formation which dominates the north-central parts of Nigeria, extends to these southwestern areas. It covers some 33,000 sq km in the Ogun River basin; 23,000 sq km in the Dasin areas of the rivers Oshun, Shasha, and Owena; and nearly 69,000 sq km of the drainage basins of the River Osse and of those rivers draining into the lower and middle Niger. Monthly streamflow forecasting models were developed for this area, using streamflow records available at 12 gauging points. With respect to the River Oshun at Iwo railway station where a longer and reliable rainfall record was available upstream and within the same basin area, a better monthly forecasting model was achieved through the use of the correlation between the longer rainfall record and the rather short streamflow data. The forecasting capabilities of these models will improve with each passing year as more data become available. (See also W87-00086) (Lantz-PTT) W87-00121

SYNTHETIC STREAMFLOW SEQUENCES FOR SOME WEST AFRICAN RIVERS, Lagos Univ. (Nigeria). Dept. of Civil Engineering. E. S. Oyegoke, O. T. Talabi, O. K. Morohunfols, and L. Oyebande.

IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg. West Germany, August 15-27, 1983. p 427-434, 2 tab, 10 ref.

Descriptors: *Synthetic hydrology, *Streamflow, *Africa, *Rivers, *Model studies, Mathematical models, Forecasting, Markov Process, Statistical models, River flow, Sanaga River, Cameroon, Statistical analysis, Drought, Floods.

A thousand years of synthetic streamflow data were generated for a set of rivers in the humid tropical region of West Africa using a lag-one Markov model. The basic statistical models and procedure employed are the normal distribution, the two-parameter lognormal distribution and Beard's procedure. The annual mean discharge values, and coefficients of variation are generally well predicted by all four models employed. As expected, the normal distribution is found inappropriate for estimating skewness since the normal distribution is a symmetric nonskewed distribution. When the skewness is very small as in the case of tion is a symmetric nonskewed unaction is a symmetric nonskewed unaction the skewness is very small as in the case

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the River Sanaga at Edea in Cameroon, the normal distribution is found to be satisfactory in reproducing swithetically each and every one of the parameters. The serial correlation coefficient is generally poorly reproduced by Beard's procedure. The two-parameter lognormal distribution is generally the best in this respect closely followed by the hormal and gamma distributions. Beard's procedure appears to be the best for reproducing the values of the flow minima for the rivers. The same can be said for the maximum flow values but perhaps with a lower level of confidence. It is concluded that no one distribution could be reserved exclusively for generating the much needed longer streamflow records for West African rivers. The normal distribution can be recommended for use when skewness is small but it cannot be relied upon for the all important extreme events necessary to forecast drought and flood flows. A closer look at the result seems to show that over the whole range of coefficients of variation encountered with West African rivers and streams, Beard's procedure is apparently the most suitable, bearing in mind that it does not predict accurately the serial correlation coefficient. (See also W87-0036) (Lantz-PTT) W87-00122

SIMULATING FLOOD HYDROGRAPHS FROM STORM RAINFALLS IN VENEZUELA,

FROM STORM RAINFALLS IN VENEZUELA, Universidad de Los Andes, Merida (Venezuela). Inst. de Geografia.

R. R. P. Ramirez, and E. M. Show.
IN: Hydrology of Humid Tronical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 435-445, 4 fig. 5 tab, 9 ref.

Descriptors: "Simulated floods, "Flood hydrographs, "Storms, "Rainfall intensity, "Venezuela, Simulated rainfall, Streamflow, Streamflow forecasting, Rainfall-runoff relationships, Guanips River, Caris River, River basins, Statistical analysis, Catchment areas, Runoff Routing Model.

sis, Catchment areas, Runoff Routing Model.

The research programme VIMHEX (Venezuela International Meteorological and Hydrological Experiment) produced valuable rainfall and stream-flow data during two summer seasons for selected drainage basins in Venezuela. Applying VIMHEX data, the forecasting of flood flows from heavy rainstorms has been investigated for the predominantly rural Guanipa River basin (4,324 sq km) in the eastern plains and for the small tributary basin of the Caris River (329 sq km). The nonlinear runoff routing model (RORB), with areal rainfall inputs computed by the Thiessen method, after calibration, simulated a test flood hydrograph with an overall goodness-of-fit of 93% for the Guanipa and 94% for the Caris. Operated in the design mode, using oally the storm rainfall data, there were errors of 4% and 1% in the simulated peak discharges for the drainage basins. Effects of the spatial distribution of storm rainfalls on the resultant stream hydrographs were also studied for the Caris basin. The areal rainfalls for six storms sampled by three rain recorders were derived by different techniques and characteristics of the output hydrographs from the RORB model were compared. It has been demonstrated that the nonlinear runoff routing model (RORB) can be applied satisfactorily to simulate the rainfall-runoff relationship and to produce flood hydrographs from storm rainfalls in Venezuela. Given good rainfall measurements, peak flows can be forecast and design floods can be derived from extreme rainfall intensities. (See also W87-00086) (Lantz-PTT)

STEADY AND NON-STEADY FLOW MODELS FOR SIMULATION OF WATER QUALITY IN RIVERS,

Instituto de Pesquisas Hidraulicas, Porto Alegre (Hrazil).

ary bibliographic entry see Field 5B.

W87-0014

ENTROPY AS A MEASURE OF HYDROLOGIC DATA UNCERTAINTY AND MODEL PER-FORMANCE, New South Wales Univ., Kensington (Australia). School of Civil Engineering.

School of Graman.
T. G. Chapman.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2,
p 111-126, June 15, 1986. 6 fig. 3 tab, 12 ref.

Descriptors: *Entropy, *Hydrologic data, *Model studies, Performance evaluation, Ephemeral streams, Mathematical analysis, Distribution graphs, Hydrologic models.

graphs, Hydrologic models.

The conceptual use of entropy is extended as a measure of uncertainty in hydrologic data and the reduction in that uncertainty due to application of a model. Use of a proportional rather than a fixed class interval, in calculations of entropy as a measure of data uncertainty, has both theoretical and practical advantages. Entropy can be readily calculated for ephemeral streams and for hydrologic variables averaged over any period, provided a log normal or gamma distribution can be fitted to the non-zero data. For other distributions, the only additional complexity is a requirement for numerical integration. For proportional class intervals, entropy and transinformation are independent of the units of measurement of the original data. For a given set, models may be compared on the basis of the transinformation, but a more general criterion of model performance for any data set is the ratio of the observed data. The results are applied to comparative evaluation of hydrologic models using the same and different data sets, and a new criterion of model performance is suggested for the latter case. (Lantz-PTT)

FLOOD SAMPLES FROM A THREE-PARAMETER LOGNORMAL POPULATION WITH HISTORIC INFORMATION: THE ASYMPTOTIC STANDARD ERROR OF ESTIMATE OF THE T-YEAR FLOOD.

d Waters Directorate, Ottawa (Ontario). R. Condie

Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 139-150, June 15, 1986. 2 fig, 3 tab, 10 ref,

Descriptors: *Flood forecasting, *Historic floods, *Statistical analysis, Flood peak, Mathematical analysis, Analysis of variance.

A series of annual peak flows obtained from recent continuous flow records, together with any historic floods or information, are treated as a censored sample from a three-parameter, lognormal population. The logarithmic likelihood function is presented in terms of the fully specified floods, the historic information with the censoring threshold, and the parameters to be determined. Maximum likelihood estimators are given as a set of three transcendental equations, which when solved give maximum likelihood estimates of parameters. The T-year flood can be expressed as a function of these parameters and the standard normal variate t. These parameters are subject to sampling variances and covariances, while t is not. From the logarithmic likelihood function, the inverse variance-covariance matrix is then derived, and by inversion gives the sampling variances and covariances of the parameters. Entering these in the general equation for the variance of estimate of a function of three variables, leads to the asymptotic standard error of estimate of the T-year flood. The method is illustrated by its application to a river with historic data, where 10 yrs of only overbank flows were available in an historic period of 35 yrs prior to the collection of a systematic record. The value of the historic information is assessed in terms of reduction of the standard error of estimate, and the 10 yrs of overbank flows together with the historic information are roughly equivalent to a 26 yr extension of the standard error of estimate, and the 10 yrs of overbank flows together with the historic information are roughly equivalent to a 26 yr extension of the standard error of estimate, and the 10 yrs of overbank flows together with the historic information are roughly equivalent to a 26 yr extension of the standard error of estimate, and the

EFFECTS OF PARAMETER UNCERTAINTY IN STREAM MODELING,

Texas Univ. at Dallas, Richardson. For primary bibliographic entry see Field 5B. W87-00222

FORMATION OF ROLL WAVES IN LAMINAR

FORMATION OF ROLL WAVES IN LAMINAR SHEET FLOW, Colorado State Univ., Fort Collins. P. Y. Julien, and D. M. Hartley. Journal of Hydraulic Research, Vol. 24, No. 1, p 5-17, 1986. 3 fig. 1 tab, 20 ref.

Descriptors: *Open-channel flow, *Flow, *Lam-inar flow, *Roll waves, *Channels, Reynolds

number.

The formation of a series of roll waves in laminar sheet flows in a smooth channel is examined both theoretically and experimentally. Roll waves were observed in subcritical flows at a Froude number as low as 0.74. The recommended theoretical relationship for the celerity of roll waves is a function of the momentum correction factor. This relationship is in good agreement with measured celerities of roll waves. The period of roll waves remained fairly constant throughout these experiments. Previous derivations of the length required for the formation of roll waves were modified because experimental evidence shows that the simplified relationship for the celerity of roll waves does not hold true for laminar sheet flows. Using the modified relationship, the dimensionless distance displays an hyperbolic variation with the Froude number and good agreement is obtained with experimental data. This analysis also demonstrates that for supercritical flows the distance is proportional to the ratio of flow, depth and slope. Alternatively an equivalent function of Reynolds number and slope can be used. (Author's abstract) W87-00321

ADAPTATION OF SECONDARY FLOW IN NEARLY-HORIZONTAL FLOW, Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering. J. P. TH. Kalkwijk, and R. Booij. Journal of Hydraulic. Research, Vol. 24, No. 1, p 19-37, 1986. 8 fig. 1 tab, 13 ref.

Descriptors: *Open-channel flow, *Flow, *Steady flow, *Secondary flow, Coriolis acceleration, Cori-olis curvature, Linearly-horizontal flow, Quasi-steady flow.

To implement the generation and decay of secondary flow in steady or quasi-steady nearly-horizon-tal flow models an approximate method is proposed which takes account of the convection of momentum of secondary flow in streamwise direction. The method is used both for the effect of Coriolis acceleration and curvature. It is shown that both effects are almost equivalent. The method is verified by comparison with results obtained in various flumes of rectangular or almost rectangular cross-section. The agreement between theory and experiments for the intensity of the secondary flow is quite satisfactory, although the theory presented cannot reproduce each detail. (Author's abstract)

MEASUREMENT OF BOUNDARY SHEAR STRESS IN NON-UNIFORM OPEN CHANNEL HOW.

Halcrow (William) and Partners, London (Eng-

land).
A. G. Maclean, and B. B. Willetts.
Journal of Hydraulic Research, Vol. 24, No. 1,p
39-51, 1986. 7 fig. 2 tab, 11 ref.

Descriptors: "Flow, "Hydraulics, "Intakes, "Sediment transport, "Mathematical models, "Openchannel flow, "Nonuniform flow, Channel flow, Shear stress, Boundary shear stress, Streams, Suction velocity, Suction zone, Model studies, Scour.

Experiments were carried out to determine the increase in boundary shear stress associated with zone of suction over a submerged type of river water intake. Conventional techniques for shear

stress measurement could not be used because of the non-uniform nature of the flow. Two different experiments were devised, and the results compared with predictions obtained from a mathematical model, based on a mean flow momentum equation written for successive bed elements in the suction zone. In one set of experiments, a grain population of known threshold shear stress, measured in uniform flow, was placed in the suction zone and the effect of suction velocity on the flow required to induce threshold conditions for these grains was determined. At threshold, shear stress was assumed to be equal in the two cases (of uniform flow, and flow with suction), the direct effect of suction on grain stability having been eliminated by suppressing suction in the immediate vicinity of the 'indicator' grains. Shear stress was also deduced from the rate of bed erosion determined by measuring the depth of scour caused by also deduced from the rate of bed erosion deter-mined by measuring the depth of scour caused by different suction velocities. The latter method was found to be more reliable and the results were in reasonable agreement with the predictions of the mathematical model. (Author's abstract)

INTERFACIAL MIXING IN STRATIFIED FLOWS, National Technical Univ., Athens (Greece). Dept. For primary bibliographic entry see Field 2H. W87-00324

FLOW AND BED DEVIATION ANGLE IN CURVED OPEN CHANNELS, Hydraulics Research Station, Wad Medani (Sudan). A. S. A. Hussein, and K. V. H. Smith. Journal of Hydraulic Research, Vol. 24, No. 2, p 93-108, 1986. 10 fig, 1 tab, 13 ref.

Descriptors: *Flow, *Base flow, *Open channels, Channels, Curved channels, Bed deviation angle, Turbidity, Shear stress, Mathematical models.

Turbidity, Shear stress, Mathematical models.

In a curved channel of limited width, such as a curved channel sediment excluder, the primary velocity distribution is affected by the effect of the restricted width/depth ratio. Using a modified logarithmic law to describe the distribution of the primary velocity on the vertical and assuming nonlinear distribution of the primary turbulent shear stress, the distribution of the radial velocity in the vertical was derived which takes into consideration the effect of the width-depth ratio. An expression for the deviation angle of the flow at the bed, reflecting the effect of the bed roughness as well as the width-depth ratio is also given. The result of the analysis is that the radial velocity distribution as well as the bed deviation angle are significantly affected by the width-depth ratio in addition to the bed roughness. Predicted and observed values compare well. The investigation is confined to variation of velocities and shear stresses in a vertical, and not laterally. (Author's abstract)

LONGITUDINAL DISPERSION IN SHIP-CANALS, Vrije Univ., Brussels (Belgium). Lab. of Hydrology. For primary bibliographic entry see Field 5B. W87-00326

TEMPORAL VARIATION OF RIVER WATER TEMPERATURES IN A DEVON RIVER TEMPERATURES IN A DEVON RIVER SYSTEM,
Exeter Univ. (England). Dept. of Geography.
B. W. Webb, and D. E. Walling.
Hydrological Sciences Journal HSJODN, Vol 30,
No. 4, p 449-464, December 1985. 7 fig, 1 tab, 28

Descriptors: *Rivers, *Water temperature, *England, *Seasonal variation, River basins, Statistical analysis, Fluctuations, Accumulation.

A ten-year study of river water temperatures at three monitoring stations on the River Exe in

England investigated temporal variation in water temperature behavior from the perspectives of annual statistics, seasonal changes, daily variation, duration characteristics and accumulated temperature. Data indicated essentially stable water temperature behavior over the ten year period. Differences between monitoring stations reflected the effect of regional and local controls as well as the effluence of hydrological factors. Despite these differences, the data collected suggest that temperature behavior was synchronous at the three stations and was essentially stable over the decade 1974-1983. (Michael-PTT) W87_00403

TOPOGRAPHIC CONTROLS OF SOIL MOISTURE DISTRIBUTIONS,

Oxford Univ. (England). Geography School. For primary bibliographic entry see Field 2G. W87-00424

LAVSED-I-A MODEL FOR PREDICTING EROSION IN BASINS AND TRANSFER OF FINE SEDIMENTS IN NORDIC WATER-SHEDS, (UN MODELE POUR PREDIRE L'ER-OSION DES BASINS ET LE TRANSFERT DE SEDIMENTS FINS DAUS LES COARS D'EAU

SEDIMENTS FING DAGGE
NORDIQUES),
Laval Univ., Quebec. Dept. of Civil Engineering.
M. Frenette, and P. Y. Julien.
Canadian Journal of Civil Engineering CJCEB,
Vol. 13, No. 2, p 150-161, April 1986. 11 fig, 3 tab,

Descriptors: *Watersheds, *Sediment load, *Model studies, Mathematical models, Mathematical stud-ies, Erosion, Basins, Nordic areas, LAVSED-I, Sediment yield, Computer models.

Computer modeling techniques are used for predicting soil losses from overland flow and subsequent suspended sediment yield from large watersheds. The model LAVSED-I is based on the universal soil-loss equation of Wischmeier and Smith and the equation of Kilinc and Richardson. The model subdivides the watershed into square units varying in size from 0.3 to 3000sq km and the computional procedure is subdivided in four components: precipitation, physical charateristics of watersheds, erosion/sedimentation, and land use. This paper describes the operational development and the application of the model to a prototype-scale water shed. A map for yearly soil loss is presented for the Chaudiere watershed (area = 5830 sq km). Results of mapping compared with esediment yield observed are shown in the paper. (See also W87-00442) (Author's Abstract) W87-00441

LAVSED-II-A MODEL FOR PREDICTING SUS-PENDED LOAD IN NORTHERN STREAMS, Laval Univ., Quebec. Dept. of Civil Engineering. For primary bibliographic entry see Field 2J. W87-00442

UNUSUAL CANADIAN FLOODS AND THE CREAGER DIAGRAM, Northwest Hydraulic Consultants Ltd., Edmonton (Alberta).

C. R. Neill. Canadian Journal of Civil Engineering CJCEB, Vol. 13, No. 2, p 255-257, April 1986. 1 fig, 1 tab, 1

Descriptors: *Floods, Creager diagrams, Canada, Probable maximum floods, Indicators.

A number of unusual flood discharges in Canada are plotted on the Creager diagram of 1945, which was based on a compilation of unusual floods in the United States and other countries. Values of Creager's coefficient C for the Canadian floods lie mainly between 20 and 45. The data appear to follow the trend of the Creager curves fairly well, although it would be possible to fit a straighter log-log curve. (Master-PTT) W87-00447

Streamflow and Runoff—Group 2E

LOWER MISSISSIPPI VALLEY FLOODS OF 1982 AND 1963, Walk. Hydel and Associates, Inc., New Orleans

W. E. Read, and M. C. Robinson.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 111, No. 4, p 434-453, October 1985. 5 fig., 1 tab.

Descriptors: *Floods, *Mississippi Valley, *Annus floods, Reservoirs, Reservoir operation, Lowe Mississippi River, U. S. Army Corps of Engineer Flood control.

Flood control.

The 1982-83 floods on the main stem and tributaries of the Middle and Lower Mississippi River spanned a six-month period from December, 1982-June 1983. The flood season was initially marked by three tributary-centered events followed by a main stem flood on the Lower Mississippi during April, May and early June. The prolonged period of high water included flash, general, and backwater flooding that prompted requests for U. S. Army Corps of Engineers assistance from states, communities, levee boards, and other local interests. The floods posed a host of difficult challenges for the Lower Mississippi River Commission (LMVD/MRC) of the U. S. Army Corps of Engineers. The task of managing the floods was compounded by the scope and complexity of the nation's largest flood control system. In addition to responding to requests for floodfight assistance, the LMVD/MRC was heavily involved in maintainting navigation, monitoring weather and hydrological data, insuring the integrity of the levee system, as well as operating reservoirs, pumping plants, the Old River Control Structures, and the Bonnet Carre Floodway. The performance of the Mississippi and Tributaries Project and elements of the LMVD program justified public investments in a reliable flood control system in the Middle and Lower Mississippi basins. (Master-PTT) W87-00500 (Master-PTT)

EXPERIMENTAL DISTURBANCE AND THE MAINTENANCE OF SPECIES DIVERSITY IN A STREAM COMMUNITY, North Carolina Univ. at Chapel Hill. Dept. of

For primary bibliographic entry see Field 2H. W87-00572

RESEARCH ON THE UNITY OF KARSTIC AQ-UIFER SYSTEMS AFTER EXAMPLES OF HELLENIC KARST (RECHERCHES SUR L'UNITE DES SYSTEMES AQUIFERES KAR STIQUES D'APRES DES EXEMPLES DU KARST HELLENIQUE), Thessaloniki Univ., Salonika (Greece). Dept. of Geology and Palseontology. For primary bibliographic entry see Field 2F. W87-00586

HYPOTHESIS-TESTING BY MODELLING CATCHMENT RESPONSE, II. AN IMPROVED MODEL, Hull Univ. (England). Dept. of Geography.

R. C. Ward. Journal of Hydrology JHYDA7, Vol. 81, No. 3/4, p 355-373, November 15, 1985. 12 fig, 2 tab, 10 ref.

Descriptors: *Hydrologic models, *Hewlett runoff hypothesis, *Algorithm, *Snow accumulation, *Snowmeit, Mathematical models, Catchwater drains, United Kingdom, Mark II catchment

The revised Mark II catchment model, which is The revised Mark II catchment model, which in-corporates the Hewlett hypothesis of runoff and is based on the author's Mark I model, has resulted in significantly better estimates of streamflow and soil moisture values than the earlier version. Much of the improvement resulted from the incorporation of a simple snow accumulation and melt algorithm and a seasonal adjustment of the Penman estimate of potential evapotranspiration. Comparisons of observed and modelled hourly streamflow have confirmed the sensitivity of the model. The high

Group 2E-Streamflow and Runoff

model efficiency values obtained appear to vindi-cate the Hewlett hypothesis of runoff generation. The main objective, to explain the hydrological behavior of the much-studied Catchwater Drain (United Kingdom), has been achieved. (Rochester-

OPEN-CHANNEL FLOW MEASUREMENTS WITH A LASER DOPPLER ANEMOMETER, Kyoto Univ. (Japan). Dept. of Civil Engineering. I. Nezu, and W. Rodi.

I. Nezu, and W. Rodi. Journal of Hydraulic Engineering (ACSE) JHEND8, Vol. 112, No. 5, p 335-355, May 1986.

Descriptors: *Flow measurement, *Open channel flow, *Lasers, *Anemometers, Velocity, Reynolds Number, Froude Number, Eddies, Viscosity, Tur-

A Laser Doppler Anemometer (LDA) system was used to measure longitudinal and vertical velocity components in two-dimensional, fully developed composents in two-dimensional, fully developed open-channel flow over smooth beds. The law of the wall and the velocity defect law were reexamined. The distributions of eddy viscosity and mixing length were evaluated and compared with those in closed channel flow. The measured turbulence intensities were also compared with the standard distributions measured in closed channels. The log-log can be applied strictly only to the near-wall region, where the von Karman constant and the integral constant are universal, regardless of the Reynolds and Froude numbers. As the Reynolds number becomes larger, the deviation from the log-law must be considered in the outer region. This deviation is expressed well by Coles wake function. The distribution of eddy viscosity and mixing length depend on the awake parameter. and mixing length depend on the awake parameter.
Over most of the channel, the turbulence intensities, made dimensionless with the friction velocity, show no dependence on the Reynolds number.
(Swanigan-PTT)
W87-00619

SIMPLE MODEL OF SEDIMENT-LADEN

Minnesota Univ., Minneapolis. St. Anthony Falls

Minnesota Umiv., Minneapolis. St. Anthony Falls Hydraulic Lab.
G. Parker, and N. L. Coleman.
Journal of Hydraulic Engineering (ASCE)
JHENDS, Vol. 122, No. 5, p 356-375, May 1986. 6
fig. 1 tab, 22 ref. NSF Grant No. NSF/EAR8213045, NSF/CEB-8204953, Sea Grant No.
DOC/NA 82AA-D-0039.

Descriptors: *Sediment transport, *Model studies, *Flows, *Suspended sediments, Open channels, Resistance, Flow velocity, Turbulent flows, Drag.

A theoretical model of sediment-laden flow was applied to dilute open channel suspensions. The model predicts the change in depth, mean velocity, resistance coefficient, and wake strength coefficient due to increasing concentrations of suspendient. The effect of the sediment is manifested in terms of a reduced depth and coefficient of resistance, and an increased mean velocity of flow. An expression for the effect of sediment on the large strength personnels (II) of the valority respective on the An expression for the effect of sediment on the wake strength parameter (II) of the velocity profile can be derived. The ratio of the power consumed by the flow in holding the sediment in suspension to the power supplied to the flow by the work of the downstream pull of gravity on the sediment is used to form a dimensionless ratio. If this ratio is less than unity, the turbulence is intensified; otherwise, it is damped. (Swanigan-PTT) W87-09620.

SLOPE-AREA DISCHARGE GAGING IN MOUNTAIN RIVERS, Institute of Hydrology, Wallingford (England).

J. C. Bathurst.

Journal of Hydraulic Engineering (ASCE)

JHEND8, Vol. 112, No. 5, p 376-391, May 1986. 7 fig. 1 tab, 13 ref.

Descriptors: *Flow discharge, *Rivers, *River beds, *Gaging, Gravel, Water surface profiles,

Flow resistance, Discharge measurement, Prediction, Errors

Tests of the alope-area gaging technique in gravel and boulder-bed rivers with slopes of 0.4-4% in upland Britain show that the field measurements must include detailed surveys of bed cross section and transverse water surface profile and that the major source of error in predicted discharge is the evaluation of the flow resistance coefficient. Surveying errors are about 9%; most errors come from over-estimation of the flow resistance coefficient. The range of error can be reduced to about 25% to 30%. The inclusion of the velocity head gradient may produce misleading results. Tests show representation of mean water surface elevation at a section by elevations measured only at the bank can cause errors comparable with those arising in the evaluation of flow resistance. (Swanigan-PTT) PTT) W87-00621

EXPLICIT COMPUTATION OF DISCONTINU-OUS CHANNEL FLOW,

Michigan Univ., Ann Arbor. Dept. of Civil Engi-

N. D. Katopodes, and C. Wu.

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 6, p 456-475, June 1986.

Descriptors: *Computer models, *Unsteady flow, *Channel flow, Surface flow, Critical flow, Open-channel flow, Finite element method, Shallow

An explicit finite element model for free-surface An explicit finite element model for free-surface flow utilizes a Taylor series expansion for integration in time coupled with the classical Galerkin variational principle. Computational and storage requirements are reduced. Stability limits are established for the method, making it suitable for computation of discontinuous as well as supercritical flow. The method is extended to two-space dimensions; computational examples show the scheme's performance in various flow conditions. The method is more efficient for problems requiring high accuracy near flow discontinuities than implicit methods with similar properties. The model is second- and fourth-order accurate with respect to the time and space increments. (Swanigan-PTT) W87-00262

RECURRENCE INTERVAL OF LONG HYDRO-LOGIC EVENTS,

Melbourne Univ., Parkville (Australia). Dept. of Civil Engineering.

R. Srikanthan, and T. A. McMahon. Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 122, No. 6, p 518-538, June 1986. 9 fig, 8 tab, 12 ref, append.

Descriptors: *Hydrologic cycle, *Mathematical studies, *Streamflow forecasting, *Reservoir operation, Prediction, Storage reservoirs, Drought.

Inconsistent results are shown to come from several empirical procedures that define the recurrence interval or probability of occurrence of long hydrologic events. An analytical procedure was developed to determine the recurrence interval of non-overlapping sums and the relationship be-tweer recurrence interval and probability is estab-lished for long duration events. The methodology is extended to determine the recurrence interval of overlapping sums. The procedure is illustrated using data from five Australian streams for both annual and monthly information. (Author's abstract) W87-00629

RELATIONSHIP BETWEEN THE RUNOFF CURVE NUMBER AND HYDROLOGIC SOIL. PROPERTIES,

Southern Illinois Univ. at Carbondale. Dept. of Plant and Soil Sciences.

For primary bibliographic entry see Field 2A

STUDY OF SYNTHETIC SEDIMENTGRAPHS FOR UNGAGED WATERSHEDS.

Transviron, Inc., Lutherville, MD.
For primary bibliographic entry see Field 2J.

DETERMINATION OF THE COMPONENTS OF STORMFLOW USING WATER CHEMIS-TRY AND ENVIRONMENTAL ISOTOPES, MATTOLE RIVER BASIN, CALIFORNIA,

MATTOLE RIVER BASIN, CALIFORNIA, Geological Survey, Menlo Park, CA. V. C. Kennedy, C. Kendall, G. W. Zellweger, T. A. Wyerman, and R. J. Avanzino. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 107-140, April 15, 1986. 9 fig, 2 tab, 70 ref.

Descriptors: *Mattole River, *Oxygen-18, *Silica, *Chlorides, *Tritium, *Deuterium, *River flow, *Storm runoff, *Chemical analysis, *Isotope studies, Rainfall, Soil chemistry, Infiltration, Soil water, Load distribution, Stream water, California, Petrolia, Discharge.

The chemical and isotopic composition of rainfall and stream water was monitored during a storm in the Mattole River basin of northwestern California. About 250 mm of rain fell during 6 days in late January, 1972, following 24 days of little or no precipitation. River discharge near Petrolia increased from 22 cu m/sec to a maximum of 1,300 cu m/sec, while chloride and silica concentrations cu m/scc, while chloride and silica concentrations decreased only from 3.2 to 2.1 and 11.5 to 8.6 mg/l, respectively. The isotopic composition changed from deltaD = 4.2%, delta (18)0 = -68%, and 40 tritium units (TU) to extreme values at highest flow of deltaD = -3.5%, delta (18)0 = -59%, and 25 TU in response to volume-weighted rainfall averaging deltaD = -1.95%, delta (18)0 = -31%, and 18 TU. The large increase in dissolved chemical load observed at maximum river discharge required that extensive interaction with, and presumably penetration of, soils occurred within a few required that extensive interaction with, and pre-sumably penetration of, soils occurred within a few-hours time. Such a large increase in chemical load also required subsurface stormflow throughout a proportion of the watershed. Chemical and isotop-ic stabilization of stormflow is believed to be due mainly to displacement of prestorm soil water, with some effects on river chemistry due to rapid rain-soil interactions. (Rochester-PTT)

SEPARATION OF A SNOWMELT HYDRO-GRAPH BY STREAM CONDUCTANCE.

Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 157-165, April 15, 1986. 4 fig, 6 ref. Japan Minis-try of Education Grant-in-Aid for Scientific Re-search 59020005, 60020003.

Descriptors: *Snowmelt, *Hydrograph, *Discharge, *Conductivity, Hokkaido, Japan, Uryu River, Runoff, Hewlett source-area concept.

By continuous measurement of stream conductance and discharge for a long snowmelt period, runoff components were separated and the dominance of subsurface flow was confirmed. This result supports a previous conclusion based on stream temperature analyses in this system (headwaters of the Uryu River, northern Hokkaido, Japan). A plot of conductance versus discharge gave a shift between rising limbs and falling limbs of a diurnal hydrograph and the shift was inverted after a snow-free area emerged adjacent to the stream channels. The shift corresponded to the change of the peak lag of the runoff components. stream channels. The shift corresponds to the change of the peak lag of the runoff components. These phenomena are considered important in relation to the variable source-area concept of Hewlett and others. (Author's abstract)

SATURATED HYDRAULIC CONDUCTIVITIES OF GRANITIC MATERIALS OF THE IDAHO BATHOLITH,

Forest Service, Ogden, UT. Intermountain Research Station.

W. F. Megahan, and J. L. Clayton. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 167-180, April 15, 1986. 7 fig, 1 tab, 30 ref.

Descriptors: *Permeability coefficient, *Idaho batholith, *Granites, *Rock properties, *Weathering, Lognormal distribution, Conditional probability analysis, Porosity, Seismic velocity, Rock fracture density, Clay formation, Mineral expansion.

Saturated hydraulic conductivity (K sub sat) of granitic bedrock in the Idaho batholith, central Idaho, was determined using a borehole pressure testing technique. Tests were conducted at approximately 1.6 m depth increments ranging from about 1.6 m to an average maximum depth of 7.8 m. A total of 58 valid tests were obtained in nine holes located at five sites in a 145-km long transect. The sites represented a wide range in rock fracturing and weathering properties. A conditional probability analysis showed that K sub sat values were lognormally distributed with a lower bound at zero. Values for K sub sat were unrelated to depth, rock matrix porosity, seismic velocity, or rock fracture density, but K sub sat varied with rock weathering characteristics. Conductivity was lowest in unweathered rock, probably because of restricted fracture apertures. The second least weathered rock class had the highest average K sub sat. There was a general decrease in K sub sat with increased weathering through the remaining five weathering classes even though rock porosity and fracture density increased with rock weathering. The inverse trend in K sub sat with increased weathering is believed to result from progressively increasing clay formation and mineral expansion that restricts flow both in fractures and the rock matrix. (Author's abstract)

VARIANCE OF THE T-YEAR EVENT IN THE

LOG PEARSON TYPE-3 DISTRIBUTION, Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). P. Ashkar, and B. Bobee.

Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 181-187, April 15, 1986. 2 tab, 10 ref.

Descriptors: *Hydrologic data, *Log Pearson Type-3 distribution, *Mixed moments, Frequency factor, Statistics.

Previous work of Phien and Hsu comparing different techniques for fitting the log Pearson type-3 (LP3) distribution to a set of observed hydrologic data is discussed. The criterion used for evaluating the performance of a particular method of estimation (the asymptotic variance of the T-year event X sub T (event corresponding to a return period T)), the application of the term 'mixed moments' to the MMI method, and approximations to the frequency factor K sub T are considered. (Rochester-PTT)

MACROINVERTEBRATE PRODUCTION IN A SOUTHEASTERN UNITED STATES BLACK-WATER STREAM,

Virginia Com of Biology. nonwealth Univ., Richmond, Dept. For primary bibliographic entry see Field 2H. W87-00668

DERIVATION OF THE PEARSON TYPE (PT)
III DISTRIBUTION BY USING THE PRINCIPLE OF MAXIMUM ENTROPY (POME),
Louisiana State Univ., Baton Rouge. Dept. of Civil

Engineering. V. P. Singh, and K. Singh.
Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 197-214, October 15, 1985. 2 fig, 3 tab, 19 ref.

Descriptors: *Principal of maximum entropy, *Flood data, *Maximum entropy, Streamflow, Sta-tistics, Probability distribution, Thermodynamics, Stream discharge, Flood discharge.

Streamflow data generally follow a skewed probability distribution. Although a specific distribution can be selected to represent the underlying distribution of streamflows, no prior knowledge exists to support the assumption that the specified distribution. The best known example of an arbitrary choice is the

work group on flow frequency methods of the Water Resources Council, which said that, the log Pearson Type III distribution is the selected base method, with provisions for departures from the base method where justified. The two-parameter (or gamma) and three-parameter Pearson Type (PT) distributions are as commonly employed in hydrology as log-normal distribution. The PT III distribution has found particular application in stochastic analysis of annual flood discharges. The object of this study was to derive the PTT III distribution using the principle of maximum entroobject of this study was to derive the PTT III distribution using the principle of maximum entropy (POME). The POME yielded the minimally prejudiced PT III distribution by maximizing the entropy subject to two appropriate constraints which were the mean and the mean of the logarithm of real values about a constant > 0. This provided a unique method for parameter estimation. Historical flood data were used to evaluate this method and compare it with the methods of moments and maximum likelihood estimation. (Khumbatta-PTT) W87-00671

REPRESENTATION OF FLOWS TO PARTIAL-LY PENETRATING RIVERS USING GROUND-WATER FLOW MODELS, University Coll., Cardiff (Wales). Dept. of Civil and Structural Engineering. For primary bibliographic entry see Field 2F. W87-00673

DIRECT THREE-PARAMETER MUSKINGUM PROCEDURE INCORPORATING LATERAL INFLOW,

Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences. T. O'Donnell.

Hydrological Sciences Journal, Vol. 30, No.4, p 479-496, December 1985. 10 fig, 5 tab, 11 ref.

Descriptors: *Muskingum procedure, *Muskingum flood routing equation, *Flood routing, *Lateral inflow parameter,Lateral flow, Least squares method, Flooding.

method, Flooding.

Considerable literature is available about the Muskingum flood routing method and its variant, the Muskingum-Cunge method. It is assumed that there is no lateral inflow along the reach through which a flood is being routed. If substantial tributaries form lateral inflow, the routing reaches may be chosen to terminate at a confluence, increasing the main channel flow by the tributary flow for the next reach. If the lateral inflow is uniformly continous along the routing reach, it is possible to modify the basic procedure. An efficient method of analysis was presented which directly yielded estimates of the coefficients in the Muskingum flood routing equation: O sub j+1 = (c sub 1 I sub j+1) (c sub 2 I sub j+1) + (c sub 3 O sub j) This equation was best explained by the least squares method. A simple conceptual model of lateral inflow was proposed and led to an extended version of the Muskingum method that had a lateral inflow parameter in addition to the standard storage and weighting parameters, K and X. Applications to a number of flood events are given and proposals for further studies were suggested. (Khumbatta-PTIT)

W87-00690

CURRENT VELOCITY IN STREAMS AND THE COMPOSITION OF BENTHIC ALGAL MATS, Kent State Univ., OH. Center for Library Studie For primary bibliographic entry see Field 2H. W87-00695

MICROHABITAT-PREFERENCE CURVES OF BLACKFLY LARVAE (DIPTERA: SIMULIDAE): A COMPARISON OF THREE ESTIMATION METHODS,

McGill Univ., Montreal (Quebec). Dept. of Biol-

For primary bibliographic entry see Field 2H. W87-00700

Streamflow and Runoff-Group 2E

FLOW REGIME, JUVENILE ABUNDANCE, AND THE ASSEMBLAGE STRUCTURE OF STREAM FISHES, North District.

North Dakota Univ., Grand Forks. Dept. of Biol-For primary bibliographic entry see Field 2H. W87-00707

AVERAGE ANNUAL DAMAGE BY FLOOD FREQUENCY ZONE,

Southampton Univ. (England). Dept. of Geogra-For primary bibliographic entry see Field 6F. W87-00742

SIMULATING THE FLOOD MITIGATION ROLE OF WETLANDS,

University of Occupational and Environmental Health, Kitakyushu (Japan). Dept. of Post Gradute Education

ate Education.
H. Ogawa, and J. W. Male.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 1, p 114128, January 1986. 6 fig. 2 tab, 27 ref.

Descriptors: *Floods, *Wetlands, *Simulation analysis, Model studies, Encroachment, Computer models, Insurance, Flood control.

A simulation methodology was developed for evaluating the flood mitigation potential of inland wetlands. Widely used computer models are accomodated by this methodology with generally available input data. Being a watershed simulation approach, the methodology can assess the potential for downstream flooding resulting from a reduction in upstream wetland storage capacities. The wetland encroachment scheme resembles the well-tested method of flood insurance studies and allows partial filling of a wetland. Simulations were performed for different antecedent moisture conditions, rainfall intensities and degrees of wetland encroachment. Results showed that encroachment on less than 25% of a wetland area would have only minimal impact on peak flows. In addition, results showed that downstream main-stem wetlands are more effective in reducing downstream flooding than upstream wetlands. (Author's abstract) abstract) W87-00743

REGIONAL SKEW WITH WEIGHTED LS RE-

REGIONAL Shert WALL GRESSION, Geological Survey, Reston, VA. G. D. Tasker, and J. R. Stedinger. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 2, p 225-237, April 1986. 4 tab, 21 ref, append.

Descriptors: *Flood forecasting, *Regression analysis, *Model studies, *Floods, *Least squares method, Mathematical studies, Mathematical models, Skew, Flood frequency.

A statistical procedure is developed for estimating generalized skew coefficients used in the WRC Guidelines for flood frequency estimation. The method is based on weighted least squares regression in which the weights are determined by separating residual variance into that due to model error and that due to sampling error. Results show that actual model errors are much smaller than estimates provided by ordinary least squares regression procedures. (Author's abstract) W87-00750

APPLICATION OF VOLTERRA SERIES TO MODELLING OF RAINFALL-RUNOFF SYS-TEMS AND FLOW IN OPEN CHANNELS, Polish Academy of Sciences, Warsaw. Inst. of Geophysics. For primary bibliographic entry see Field 2A. W87-00774

PHYSICALLY BASED HYDROLOGICAL FLOOD ROUTING METHODS, of Sciences, Warsaw. Inst. of

Group 2E-Streamflow and Runoff

Geophysics.

Z. W. Kundzewicz. Hydrological Sciences Journal HSJODN, Vol. 31, No. 2, p 237-261, June 1986. 8 fig. 3 tab, 30 ref.

Descriptors: *Model studies, *Flood routing, *Open channels, *Channel flow, River flow, Computer models, Channel inflow, Flow, Deterministic models, Stochastic models, Routing.

Alternative ways have been examined for developing relationships between the parameters of conceptual hydrological flood routing models and the
physics (understood as the hydrodynamic model or
as the real system). Three deterministic and two
stochastic methods of synthesis of conceptual parameters were studied. The results offer aid in
identification of conceptual parameters when modeling systems for which no historical time series of
inflow-outflow data are available (e.g., ungaged
rivers or river engineering design). The synthesis
of conceptual hydrological flood routing and rainfall-runoff models will remain one of the principal
directions of future hydrological research. (DoriaPTT) PTT W87-00777

APPLICATION OF THE GEOMORPHOLOGI-CAL INSTANTANEOUS UNIT HYDROGRAPH THEORY TO DEVELOPMENT OF FORECAST-ING MODELS IN POLAND,

Institute of Meteorology and Water Management, Warsaw (Poland).

J. Zelazinski. Hydrological Sciences Journal HSJODN, Vol. 31, No. 2, p 263-270, June 1986. 1 fig, 4 ref.

Descriptors: *Forecasting, *Flood forecasting, *Unit hydrographs *Hydrography, *Model studies, *Poland, Flood protection, Reservoir operation, Decision making, Catchment areas, Flood hydrographs.

Geomorphological instantaneous unit hydrograph (GIUH) theory has been applied to estimate the parameters of two conceptual models: a linear cascade model and a Laurenson-type model, for flood protection and reservoir operation in the Upper Vistula basin in Poland. Conceptual models, especially the linear cascade model, are more convenient for operational forecasting than the original GIUH model. A single linear reservoir model is auggested, with limited storage to represent the subsurface flow component. Subsurface flow is significant in Polish mountainous river catchments. Freliminary results of applying the model to oper-Preliminary results of applying the model to oper-ational flood forecasting are described. (Author's abstract) W87-00778

VARIABLE SOURCE AREAS AND STORM-FLOW GENERATION: AN UPDATE OF THE CONCEPT AND A SIMULATION EFFORT, Georgia Univ., Athens. School of Forest Reary bibliographic entry see Field 2A.

SOIL PROPERTIES AFFECTING RUNOFF, Western Australia Dept. of Agriculture, South For primary bibliographic entry see Field 2G. W87-00784

TRACTIVE STRESS AND THE ONSET OF BED PARTICLE MOVEMENT IN GRAVEL STREAM CHANNELS: DIFFERENT EQUA-TIONS FOR DIFFERENT PURPOSES, McGill Univ., Montreal (Quebec). Dept. of Geog-

M. A. Carson, and G. A. Griffiths. Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 375-388, July 30, 1985. 3 fig, 25 ref.

Descriptors: *Sediment transport, *Bedload, *Al-luvial channels, *Tractive forces, *Gravel, Streams, Channels, *Entrainment, Particle size, *Mathematical studies.

There is apparent discordance among the many empirical equations used to relate the critical trac-tive stress tau sub c for gravel entrainment in river channels to particle size (d). Similar inconsistencies channels to particle size (d). Similar inconsistencies exist between those equations and analogous formulae relating channel competence d sub max to actual tractive stress tau. Much of this discordance results from the fact that many of the equations genuinely reflect different populations and hence have distinctly different purposes. Comparison among them is not justified. Seven different types of equation are identified: (1) the basic tau sub c - d relationship applicable to different gravel-bed rivers and to different discharges in a single stream; (2) the tau sub c - d relationship for different channels, each of which has uniform bed material; (3) the tau sub c - d relationship for different channels, each of which has uniform bed material;
(3) the tau sub c - d relationship for different
channels (with non-uniform bed gravel) az applied
to mediam-size bed particles; (4) the full tau sub c d relationship for single streams; (5) the d sub max
- tau relationship for single streams; (6) the d sub
max - tau relationship for different streams at bankfull stage; and (7) the d sub max - tau relationship
for different streams in extreme floods. Identification of these separate types of relationships helps
explain the inconsistencies and emphasizes the importance of clearly defining 'purpose' or 'population' in utilizing these equations. (Author's abstract) W87-00787

PARAMETER VALUES FOR SNOWMELT RUNOFF MODELLING,

RUNOFF MODELLING, Eidgenoessisches Inst. fuer Schnee- und Lawinen-forschung, Davos (Switzerland). J. Martinec, and A. Rango. Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 197-219, May 30, 1986. 13 fig, 2 tab, 33 ref.

Descriptors: *Snowmelt, *Runoff, *Hydrologic models, *Watersheds, *Runoff coefficient, *Critical temperature, *Time lag, *Recession coefficient, Rain, Snow, Mathematical models, Degree-days, Model studies, Temperature lapse rate.

Parameters that appear frequently in snowmelt runoff models are analyzed with the aim of facili-tating their evaluation. Results of runoff computations by the Snowmelt Runoff Model (SRM) cartions by the Snowmelt Runoff Model (SRM) carried out at various institutes, universities, and agencies on 24 basins ranging in size from 0.77 to 4,000 aq km, and in elevation from 171 to 6,000 m above sea level, in 11 countries are reviewed. Based on this review, the physically and hydrologically understandable range of parameter values is assessed for the degree-day factor, runoff coefficient, temperature lapse rate, critical temperature (rainsaow), time lag, and recession coefficient. Consideration of SRM parameter values in these previous applications may prove valuable for SRM applications on other basins and for initial selection of related parameter values in other anowmelt runoff models. (Author's abstract) W87-00810

THORNTHWAITE-MATHER PROCEDURE AS A SIMPLE ENGINEERING METHOD TO PRE-DICT RECHARGE, New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineer-

For primary bibliographic entry see Field 2F. W87-00811

INFILTRATION INTO DECOMPOSED GRAN-ITE SOILS: NUMERICAL MODELLING, AP-PLICATION ON SOME LABORATORY OB-

SERVATIONS, Hong Kong Univ. Dept. of Civil Engineering. For primary bibliographic entry see Field 2G. W87-00812

IDENTIFICATION OF HOMOGENEOUS RE-GIONS FOR FLOOD FREQUENCY ANALYSIS, Institute of Hydrology, Wallingford (England). Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 287-302, May 30, 1986. 8 fig, 2 tab, 9 ref.

Descriptors: *Catchment basirs, *Classification, *Flood frequency, *Homogeneity, *Rainfall, *Drainage area, Data Base, Urban fraction, Britain, Quantile estimation, Regional boundaries, Statis-

Basins may be classified into distinct, homogeneous groups for regional flood frequency analysis, using a scheme which consists of an iterative search through the basin characteristic database which optimizes statistics that describe the efficiency of a scheme which consists of an iterative search through the basin characteristic database which optimizes statistics that describe the efficiency of grouping. Application of the procedure to basins in Britain yields five groups formed on the basis of basin area, average rainfall, and urban fraction. Four of these groups are homogeneous with respect to the coefficient of variation of the annual maximum flood series. The properties of these groups compare favorably with 10 geographic regions previously used for flood analysis in Britain. There are two weaknesses to the procedure. The first of these is that the annual maximum series of each site is characterized only by the coefficient of variation of the series. The second problem is that the resulting solution in terms of basin groupings may not be unique, i.e., different basin characteristics may also produce a statistically significant result. This second problem is unlikely to be serious as both physical reasoning and the behavior of geographic regions can supplement the analysis of the test statistics. The use of this approach to region definition does not guarantee reliable flood quantile estimates: There is always likely to be a persistent minority of basins which defies successful allocation into homogeneous groups. Indeed the level of homogeneity deemed acceptable in a region or group is somewhat arbitrary and it is not known at this stage what level of heterogeneity can be tolerated in a region. Research is in progress to assess the relative importance of different sources of error in the index flood method and methods of incorporating additional information from the flow data in the description of homogeneity are being investigated. (Lantz-PTT)

CLASSIFICATION OF DRAINAGE BASINS AC-CORDING TO THEIR PHYSICAL CHARAC-TERISTICS; AN APPLICATION FOR FLOOD FREQUENCY ANALYSIS IN SCOTLAND,

Saint Andrews Univ. (Scotland). Dept. of Geogra-

phy.
M. C. Acreman, and C. D. Sinclair.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 365-380, May 30, 1986. 4 fig. 3 tab. 29 ref,

Descriptors: *Drainage basins, *Classification, *Flood frequency, *Scotland, *NORMIX algo-rithm, Multivariate clustering, Standardized floods, Regional analysis, Statistical analysis, Algorithms, Mathematical studies.

Mathematical studies.

If the standardized floods at all sites within a given region are assumed to be samples from the same distribution, all data may be combined to yield an estimate of the regional dimensionless flood frequency relationship. The identification of these hydrologically homogeneous regions can be achieved on the basis of the physical characteristics that control the hydrological processes. Classification of the basins independent of the discharge data avoids the problems of regionalization based on the highly variable individual site estimates of flood frequency. Classification of the basins can be performed using the NORMIX multivariate clustering algorithm. The homogeneity of the basins can be tested using a likelihood ratio test of whether standardized data for all basins within a region may be adequately represented by a single regional flood frequency relationship. The method was applied to 168 basins in Scotland and five regions were identified corresponding to physically reasonable basin types and all but one of which yield homogeneous distributions of flood frequency. (Author's abstract) (Author's abstract) W87-00821

TURBULENT STRUCTURE IN A RIVER

Hydraulics Research Station, Wallingford (Eng-

Groundwater-Group 2F

land).
H. O. Anwar.
Journal of Hydraulic Engineering (ASCE)
JHEND8, Vol. 112, No. 8, p 657-669, August 1986.
12 fig, 23 ref, append. Department of the Environment (U.K.) Contract No. DGR/465/35.

Descriptors: *Flow velocity, *River bends, *Turbulence, *Water currents, *Chemical morphology, *River beds, Topography, Meandering, Mathematical models, England, Flow pattern, Flow velocity, Shear stress, Stress.

A field experiment was carried out in a bend in a small river in Oxfordshire (United Kingdom) and velocity components were measured in the longitudinal, lateral, and vertical directions at various cross sections within the bend. The bed topography also was determined. Isovels, equal contours of the lateral mean velocity, of the Reynolds shear stress and normal stresses were obtained. In the straight reach upstream from the bend the velocity profile in the mean flow direction was logarithmic. This was not the case within the bend. The isovels at the bend entrance were not affected by the flow curvature. This was not true for the bend exit. The mean lateral velocity became appreciable in the bend. The contours of constant lateral velocity showed a water movement toward the outer bank with a zero contour near the bed, below which there was a flow towards the inner bank. Equal contours of the normal stresses, in three directions, at the bend entrance were affected by the curved flow. The stress contours changed greatly within the bend with the water was the first surface of the at the bend entrance were affected by the curved flow. The stress contours changed greatly within the bend, with maxima near the free surface of the outer bank, and also in the deepest parts of the sections. The Reynolds shear stress in the mean flow direction at the bend entrance was sensitive to the curved flow. The contours of constant shear stress were distorted within the bend. The maximum value of the lateral Reynolds shear stress occurred near the outer bank at the bend exit without meandering. The turbulent production term for the lateral direction, being large near the outer region and decreasing toward the inner bank and bend exit. (Lantz-PTT)

STABLE CHANNELS WITH MOBILE GRAVEL

BEDS, University of East Anglia, Norwich (England). School of Environmental Sciences.

University of East Anglia, Norwich (England). School of Environmental Sciences.
R. D. Hey, and C. R. Thorne.
Journal of Hydraulic Engineering (ASCE)
JHENDS, Vol. 112, No. 8, p 671-689, August 1986.
2 fig, 3 tab, 29 ref, append.

Descriptors: *Gravel, *Regime equations, *River beds, *Bed load, *United Kingdom, *Pool-and-riffle topography, *Regime channels, Multiple regression analysis, Riffles, Simuosity, Average velocity, Slope, Bankfull discharge, Hydraulic geometry, Statistics, Vegetation effects, Bank stabilization, Depth.

Regime-type equations for mobile gravel-bed rivers are presented, based on data obtained from 62 gravel-bed river reaches in the United Kingdom. Multiple regression techniques were applied to derive equations relating reach average and riffle values of width, mean and maximum depth, slope, velocity, sinuosity, and riffle spacing to bankfull discharge, bed and bank material characteristics, valley slope, bank vegetation type, and an independent estimate of bankfull bed load transport rates. Although discharge has a dominant control on channel geometry, the equations indicate that bed load discharge also has a significant influence, particulerly with regard to channel slope. Bank vegetation has a major control on width and velocity, whereas depth, velocity, and slope were strongly affected by bed material size. Reasons for these results are considered in terms of the physical processes controlling channel adjustment. The application of these regime equations is discussed, and particular consideration is given to the design of sinuous channels with a pool-riffle bed topography. (Author's abstract)

ARMORING AND SORTING SIMULATION IN ALLUVIAL RIVERS,

Iowa Univ., Iowa City. Inst. of Hydraulic Re-

search.
M. F. Karim, and F. M. Holly.
Journal of Hydraulic Engineering (ASCE)
JHEND8, Vol. 112, No. 8, p 705-715, August 1986.
6 fig, 10 ref.

Descriptors: *Bed armoring, *Sediment sorting, *Equations, *Bed-forms, *Missouri River, *Bed-load, Gavins Point Dam, Alluvium, Simulation analysis, Particle size.

analysis, Particle size.

Formulations for bed armoring and hydraulic sorting of bed sediments in alluvial streams are developed, with an application to Missouri River bed evolution. A relation for the areal coverage factor for armoring on a plane bed is formulated first as a function of degradation depth and bed-material characteristics, and then is modified by introducing correction factors for the effect of bed forms and the stochastic nature of sediment motion. For the simulation of hydraulic sorting, bed sediments are assumed to be mixed homogeneously in a mixed-layer depth approximately equal to the average bed-form height, and the composition of mixed-layer materials is adjusted to satisfy the continuity equation for each sediment size fraction. These formulations are applied in a 20-yr simulation of bed degradation in the middle Missouri River reach downstream of Gavins Point Dam. The simulated bed-sediment composition, including the two-layer structure comprising the top armor coat and the underlying finer sediments, agrees well with the observed Missouri River bed characteristics. (Author's abstract)

DIFFUSION WAVE MODELING OF CATCH-MENT DYNAMICS, San Diego State Univ., CA. Dept. of Civil Engi-

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 8, p 716-727, August 1986. 4 fig. 3 tab, 20 ref.

Descriptors: *Diffusion wave model, *Catchment basins, *Kinematic wave theory, *Diffusion wave theory, Numerical analysis, Numerical diffusion, tion, Model studi

A diffusion wave method for catchment dynamics is presented. The method has better convergence properties than kinematic wave models, which use off-centered derivatives in their numerical formulations. Unlike the off-centered schemes, the diffusions durations and leads to simulations that essentially are independent of grid size. The diffusion method is further extended to the realm of dynamic waves by including the Frouden number dependence of the physical diffusivity. The resulting formulation is believed to represent as complete a description of the wave dynamics as is possible within the framework of diffusion wave theory. Numerical experiments show that the diffusion wave method has better convergence properties than existing kinematic wave models featuring uncontrolled numerical diffusion. (Author's abstract)

CORIOLIS GENERATED SECONDARY CUR-RENTS IN CHANNELS, Lulesa Univ. (Sweden). Div. of Water Resources

Engineering.
For primary bibliographic entry see Field 8B.
W87-00829

2F. Groundwater

LOCALIZED MIXING OF LOW SALINITY PATCHES IN A PARTIALLY MIXED ESTU-ARY (SOUTHAMPTON WATER, ENGLAND), te of Oceanographic Sciences, (England). For primary bibliographic entry see Field 2L.

GROUNDWATER RESOURCES: INVESTIGA-TION AND DEVELOPMENT, Hebrew Univ. of Jerusalem (Israel). Groundwater

Research Center. For primary bibliographic entry see Field 4B. W87-00041

PROCEEDINGS OF THE ASSOCIATION OF GROUND WATER SCIENTISTS AND ENGINEERS: WESTERN REGIONAL GROUND WATER CONFERENCE,

Water Well Association, Worthington, OH.

Available from the National Water Well Associa-tion, 500 W. Wilson Bridge Rd., Worthington, OH. 43085. January 15-16, 1985, Reno, Nevada. 1985.

Descriptors: *Groundwater, *Conference Groundwater pollution, Path of pollutant Groundwater movement, Artificial recharge Groundwater management, Model studies. *Conferences recharge

These proceedings are a compilation of papers on groundwater in the western U.S.. The conference covered several topics, including groundwater contamination investigations, groundwater and contaminant flow in fractured rock, artificial recontaminant flow in fractured rock, artificial recharge in groundwater management, nuclear waste site selection, the impact of mining on groundwater, groundwater modeling, understanding U.S. EPA programs and regulations, and regional geology. Government officials, consulting geologists engineers and researchers, industry representatives and other interested persons met to learn and discuss state-of-the-art techniques employed in groundwater studies. (See also W87-0005) (Author's abstract) W87-00050 (M87-0005)

GROUND WATER RECHARGE WITH STORM-WATER COLLECTED IN PLAYA LAKES Texas Tech Univ., Lubbock. Dept. of Civil Engineering. For primary W87-00051 nary bibliographic entry see Field 4B.

CONTROL OF GROUND WATER CONTAMI-NATION AT AN ACTIVE URANIUM MILL, Earth-Fax Engineering, Inc., Murray, UT. For primary bibliographic entry see Field 5G. W87-00052

USE OF SODIUM SULFIDE TO RESTORE AQUIFERS SUBJECTED TO IN SITU LEACH-ING OF URANIUM ORE DEPOSITS, Battelle Pacific Northwest Labs., Richland, WA. For primary bibliographic entry see Field 5G. W87-00054

HYDROLOGIC MODELING FOR IDENTIFI-CATION OF SALINITY SOURCES IN A STREAM-AQUIFER SYSTEM, A CASE STUDY, Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W87-00055

SOLUTE TRANSPORT IN A GROUNDWATER SYSTEM WITH REVERSING REGIONAL GRA-

Nevada Univ. System, Reno. Water Resources

L. Bruce, and S. W. Wheatcraft.

In: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 186-205, 8 fig. 11 ref.

Descriptors: *Solute transport, *Groundwater, *Regional gradients, Topaz Lake, Nevada, Alluvi-al aquifers, Path of pollutants, Finite element method, Mathematical studies, Hydrogeology, Simulation analysis, Water pollution sources, Re-

Group 2F-Groundwater

The nonreversible nature of solute transport was investigated by posing a hypothetical pollution scenario for Topaz Lake, Nevada and the hydraulical yconnected alluvial aquifer. Topaz Lake, an off-stream storage reservoir, was considered a source of contamination for the alluvial aquifer during a one year period and a contaminant sink for the aquifer during the remaining time of the scenario annulation. The extent of aquifer contamination and the required time for aquifer clean-up was estimated by initially using a one-dimensional finite element solute transport model to gain insight into the nonreversible nature of solute transport and finally using a two-dimensional finite different solute transport model to simulate the most realistic hydrogeologic conditions for the alluvial aquifer. Both models used a sinusoidal function to simulate Topaz Lake head fluctuation generated by the cyclic operation of the reservoir during the predictive phase of the simulation. The two-dimensional model considered mountain front recharge accounting for approximately 70% of the total annual recharge to the alluvial aquifer. Results from the two-dimensional model showed for an unconfined aquifer contamination invaded 400 feet into the aquifer and required 9.5 years to remove. Results from the one-timensional model with no mountain front recharge showed for a confined aquifer contamination invaded approximately 1540 feet and a contaminate concentration < 10% was not removed from the aquifer after 21 years. General results from both models showed irreversible contamination fron lovely pollutants when the alluvial aquifer was considered to be confined and receiving no mountain front recharge. (See also W87-00049) (Author's abstract) ing no mountain front re 00049) (Author's abstract)

MODELING OF FLOW AND CONTAMINANT TRANSPORT IN FRACTURED ROCK RELAT-ED TO HIGH-LEVEL NUCLEAR WASTE RE-

POSITORY, Nevada Univ. System, Reno. Water Resources

For primary bibliographic entry see Field 5B. W87-00057

GROUND WATER ASSESSMENTS UNDER THE RESOURCE CONSERVATION AND RE-COVERY ACT.

tal Protection Agency, Denver, CO. Region VIII. For primary bibliographic entry see Field 5G. W87-00058

PREVENTING GROUND WATER CONTAMINATION FROM UNDERGROUND STORAGE

Environmental Protection Agency, Denver, CO. Region VIII. For primary bibliographic entry see Field 5G. W87-00059

EXPLORING FOR GROUND WATER IN FRACTURED CARBONATES: EAST-CENTRAL NEW MEXICO,

Geoscience Consultants Ltd., Albuquerque, J. C. Hunter, and A. A. Gutierrez.
IN: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 274-280, 3 fig. 2 ref.

Descriptors: *Exploration, *Groundwater potential, *Groundwater mining, *New Mexico, *Geologic fractures, *Carbonate rocks, Water supply development, Potential water supply, Water reaources development. Sandia Mountains, Manzano

Much of the region east of Sandia and Manzano mountains near Albuquerque, New Mexico is underlain by gently-dipping limestones of the Madera Formation (Pennsylvanian). Bulk porosity, storativity and conductivity of these rocks are very low, and many wells in this area produce only 1 gallon per minute or less. A few wells (located in narrow, discrete fracture zones) are considered and any control of the contr crete fracture zones) are considered good pro-

ducers with specific capacities of 7 - 10 gallons/minute/ft of drawdown. Wells in these fracture zones also have storativities and conductivities several orders of magnitude greater than in the unfractured host rock, and static water levels as much as 100 ft higher than adjacent wells. Pump-test results from wells in fractures show that drawdown is proportional to the source root of numning time, as from wells in fractures show that drawdown is proportional to the square root of pumping time, as predicted by mathematical models. Hydrologically significant fractures lie in an orthogonal pattern (N. 80 W. and N. 20 E.) with a spacing of 1/4 to 1 mile, and are typically 10 - 50 ft wide. Prospective fracture zones are located by an iterative process which combines data from aerial photograph analysis and field mapping with potentiometric-surface and well productivity surveys. Lineaments mapped on aerial photographs are field-checked, and the productivity of wells located in or near these zones is examined. Lineaments which are associated with highly productive wells become the primary taris examined. Lineaments which are associated with highly productive wells become the primary targets for exploratory drilling. Use of these methods has recently lead to the completion of a successful well (65,000 gallons/ day) for a community of 250 in this area. (See also W87-00049) (Author's abstract) W87-00060

GEOLOGICAL CAUSES OF THE HYDROLOGY OF SOUTHERN ARIZONA'S BASIN AND

RANGE PROVINCE,
AZ Geotechnics, Inc., Tucson, AZ.
J. C. Wilt, and G. L. Hix.

Nr. Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 281-303, 9 fig. 38 ref.

Descriptors: *Geohydrology, *Geologic history, *Arizona, *Geologic formations, Groundwater hy-drology, Rocks, Plate tectonics, Horsts, Grabens,

Understanding the timing, sequence, and mechanisms of geologic events causing the present topography in Arizona's Basin and Range Province is extremely important for engineers, hydrologists, and hydrogeologist working in these basins because these geological factors control the groundwater quantity, quality, and movement within the present basins. This paper summarizes recent geological concepts by researchers in academia, state and national geological surveys, and the oil and eas and national geological surveys, and the oil and gas and minerals industries from literature that is seldom seen by engineers or hydrologists. The rocks produced by the earliest Tertiary episode of rocks produced by the earliest Tertiary episode of mountain building - the Laramide orogeny - occur in the rock pediments and in the mountain blocks. This orogeny lasted from approximately 85 - 43 million years ago when the Farallon plate on the west was subducted under the North American plate at increasingly faster rates and therefore at mcreasingly shallower angles. Within the fringes of the mountain pediments and buried in the lower parts of the basins are the sediments and volcanic rocks of the next mountain building episode - the mid-Tertiary orogeny. Fine- and coarse-grained sedimentary and volcanic rocks were deposited from 43 - 13 million years ago when the Farallon plate that had been subducted under the North American plate continued to drop at an increasingly steeper angle. The present topography of southern and western Arizona resulted from the creation of horsts and grabens along steep normal faults ern and western Arizona resulted from the creation of horsts and grabens along steep normal faults during the Basin and Range Disturbance beginning about 13 million years ago. When the San Andreas fault sliced off part of the subducting slab under North America, parts of the crust collapsed into deep grabens. These grabens are filled with relatively flat-lying sediments containing the majority of the state's groundwater resources. (See also W87-00049) (Author's abstract) W87-00061

HYDROGEOLOGY OF THE PORTLAND BASIN, Applied Geology, Aloha, OR. W. F. Hoffstetter.

W. F. Honstetter.

In: Proceedings of the Association of Ground
Water Scientists and Engineers: Western Regional
Ground Water Conference, January 15-16, 1985,
Reno, Nevada. 1985. p 304-310, 6 ref.

Descriptors: *Geohydrology, *Portland, *Rivers, *Aquifers, *Groundwater quality, *Groundwater management, Alluvial aquifers, Confined aquifers, Unconfined aquifers, Oregon, Washington, Columbia River, Willamette River, Groundwater reharge, Groundwater depletion, Competing use.

charge, Groundwater depletion, Competing use. The Portland Basin is an enclosed structural basin dissected by two major rivers and several tributaries. Alluvium is present in the basin to depths in excess of 1,000 ft. Two large urban areas, Portland, Oregon, and Clark County, Washington, with populations of over one million have developed groundwater supplies from the confined and unconfined alluvial aquifers. Aquifers consist of fluvial-lacustrine deposits of the ancestral Columbia River, Willamette River, and their tributaries, and of volcanic bedrock around the periphery of the basin. The age of the aquifers ranges from Tertiary to Recent. Water right permits for groundwater exceeds 350 million gallons per day (mgd), but actual withdrawal is roughly 100 mgd. Future industrial and population growth presents the possibility of overdraft in some areas. Water quality of the groundwater is generally good because of high quality recharge water and the volcanic origin of the aquifer materials. Primary water quality problems are with iron/manganese and nitrate contamination from sewage and agriculture. Volatile organic contaminants have been recorded in several wells, and present a threat to groundwater users. Management of the groundwater resource needs to be improved to prevent further contamination of aquifers and the overdraft of aquifers. (See also W87-00062 W87-00049) (Author's abstract)

APPARATUS FOR GROUND WATER CHEM-ISTRY INVESTIGATIONS IN FIELD CAIS-

SONS, Los Alamos National Lab., NM. For primary bibliographic entry see Field 2K. W87-00065

EVALULATION OF PROCEDURES FOR DE-TERMINING SELECTED AQUIFER PARAM-

Cold Regions Research and Engineering Lab., Hanover, NH. For primary bibliographic entry see Field 7A. W87-00071

PUMPING TEST OF WELL CAMPBELL ET AL. NO. 2 GILA HOT SPRINGS, GRANT COUNTY, NEW MEXICO,

ers (W.K.) and Associates, Inc., Socorro,

NM.

G. E. Schwab, W. K. Summers, R. M. Colpitts, C.
E. Teuten, and W. K. Wong.

Available from the National Technical Information
Service, Springfield, VA. 22161, as DE82-012029,
Price codes: A06 in paper copy, A01 in microfiches,
Report No. EGG-2156, March 1982. 184 p, 13 fig.,
4 tab, 14 ref, 8 append. Contract No. DE-AC07761D01579. 761D01570.

Descriptors: *Pump testing, *Water yield, *Wells, *Gila Hot Springs, *New Mexico, Discharge frequency, Chemical analysis, Transmissivity, Storati-

Well Campbell et al. No. 2 near Gila Hot Springs in Southwestern New Mexico was pumped for a five-step test and a 48-hour constant-rate test during October 1981. Measurements included during October 1981. Measurements included depth to water in the pumping well and two observation wells, and discharge rates at the pumping well and two springs. The water level in the pumping well responded during both tests. However, water-level changes in the observation wells were to carell for medicinal was and discharge. water-level changes in the observation wells were too small for analytical use, and discharge rates from springs showed no change. Chemical analyses of water samples collected from two springs and the pumping well show very similar water chemistries. Estimates of hydraulic properties show transmissivity from 12,000 to 14,000 gallons/day (gpd)/ ft and a storativity of 0.05. Combining these parameters with well data gives the first-year optimum discharge rate as 50 gallons/m (gpd) with 20

Groundwater-Group 2F

feet of drawdown. Pumping this well at 50 gpm for forty years should produce only small water-level changes in wells a few hundred feet away. It would diminish the flow of the springs, and for planning purposes the combined discharge of the springs and well should be considered constant. springs and well s (Author's abstract) W87-00081

GROUNDWATER HYDROLOGY IN AGRICUL-TURE OF THE HUMID TROPICS, For primary bibliographic entry see Field 4B. W87-00104

METEOROLOGICAL FEASIBILITY OF WIND-MILIS FOR WATER SUPPLY IN NORTHERN MALAWI, Northumbrian Water Authority, Gosforth (Eng-

land). For primary bibliographic entry see Field 3B. W87-00113

EFFECTS OF WASTE DISPOSAL ON GROUNDWATER AND SOURCE WATER. International Association of Hydrological Sci-

For primary bibliographic entry see Field 5C. W87-00126

INTERFLOW BETWEEN RECHARGE AND ABSTRACTING WELLS IN AMBIENT CON-FINED AQUIFER FLOW, Lancaster Univ., Bailrigg (England). Dept. of En-vironmental Sciences.

T. O'Donnell

T. O'Donnell.
IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 37-47, 8 fig, 3

Descriptors: *Groundwater movement, *Recharge wells, *Abstracting wells, *Confined aquifers, Interflow, Aquifer systems, Groundwater pollution, Recharge, Flow profiles.

terflow, Aquifer systems, Groundwater pollution, Recharge, Flow profiles.

Polluted water is sometimes disposed of by discharge into aquifers through recharge wells. Even if not physically, chemically or biologically contaminated, clean recharge water may differ from the receiving ambient groundwater in temperature or in hardness. If there is a pumped well abstracting water from an aquifer in the vicinity of a recharge well, it is of significance to be able to estimate how much (if any) of the recharge water flows to and is abstracted from the pumped well. This is fairly easily resolved if the groundwater in the aquifer is static. However, it is rare for aquifers not to have a natural areal flow prior to the installation of wells. Clearly the patterns of flow between and in the vicinity of recharging and abstracting wells superimposed on an ambient flow field will be affected by the direction and strength of such ambient flow. The generality includes an ambient horizontal flow in the aquifer at an angle to the line joining the source and sink wells, and inequality of the source and sink strengths. Particular attention is paid to the quantity (if any) of recharged water entering the pumped well. An analytical solution has been found to the relationship for the amount of interflow (if any) between a recharging well and a nearby abstracting well of different strengths penetrating a confined aquifer carrying an ambient flow field. The solution is presented both algebraically and graphically. While the intuitive expectation is that, to prevent interflow, the recharge well should be downgradient from the abstraction well, the interesting result found for wells of equal strengths is extended to the more general case of unequal strengths: the closest permissible position for the recharge well to avoid interflow is not directly downgradient, but at some angle in the range 45 - 50 degrees to that direction. Interflow can occur at all angles made by the ambient aquifer flow with the line joining the two wells, depending o

determination of how any or all of these parameters can be made to avoid any interflow, and they will be of use in the design of waste disposal systems in which polluted water is to be discharged down boreholes into aquifers from which pumped water-supply wells take their supply. (See also W87-00127) (Lantz-PTT)

INVESTIGATIONS INTO DOMESTIC REFUSE LEACHATE ATTENTUATION IN THE UNSATURATED ZONE OF TRIASSIC SAND-

Severn-Trent Water Authority, Birmingham (England).

For primary bibliographic entry see Field 5B. W87-00139

HYDROLOGICAL ASPECTS OF SEALING WASTE TIPS WITH LINERS AND SOIL COVERS,

Instituut voor Cultuurtechniek en Waterhuishoud-ing, Wageningen (Netherlands). For primary bibliographic entry see Field 5G. W87-00140

ORIGIN AND FORMATION OF THE UNDER-GROUND WATER POLLUTION IN XIAN, First Hydrogeology Team of Shaanxi Province, Xian (China). For primary bibliographic entry see Field 5B. W87-00142

MODELLING OF POLLUTION-TRANSPORT IN AQUIFERS - INFLUENCE OF THE STRUC-TURAL VARIATION, Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-

Vizgazdatkodasi Tudomanyos Kutato Intezer dapest (Hungary). For primary bibliographic entry see Field 5B. W87-00146

EFFECTS OF COAL MINE WASTES OF NORDRHINE-WESTPHALIA ON GROUND-

NURDERHINE-WESTA WATER, Kiel Univ. (Germany, F.R.). Geologisch-Palaeon-tologisches Inst. und Museum. For primary bibliographic entry see Field 5C. W87-00150

PRELIMINARY ASSESSMENT OF THE RE-GIONAL DISPERSIVITY OF SELECTED BASALT FLOWS AT THE HANFORD SITE, WASHINGTON, USA, Texas A and M Univ., College Station. Dept. of

Geology.
For primary bibliographic entry see Field 5B.
W87-00160

HYDROGEN ISOTOPE STUDY OF LARGE-SCALE METEORIC WATER TRANSPORT IN NORTHERN CALIFORNIA AND NEVADA,

California Univ., Davis. Dept. of Geology.
N. L. Ingraham, and B. E. Taylor.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2,
p 183-197, June 15, 1986. 5 fig, 1 tab, 24 ref.

Descriptors: "Meteoric water, "Water transport, "California, "Nevada, "Deuterium, Groundwater, Hydrologic studies, Rayleigh distillation, Water budget, Evapotranspiration.

The depletion of deuterium in surface- ar groundwaters along a traverse through Northern California and Nevada is used to model the local California and Nevada is used to model the local hydrologic balance as controlled by the eastward flux of meteoric water in a way not possible by conventional methods. When plotted against distance from the Pacific Ocean, the data indicated three hydrologic provinces, which differ in their relative degree of openness. Isotopic variations of groundwater in the first province is governed by Rayleigh distillation from the eastward-moving storm clouds. Some 40% of the storm water vapor precipitates out before reaching the California coast, and another 16% in the first 55 km across the continent. The isotopic depletion in the second

hydrologic province is linear with distance, sughydrologic province is mear with distance, sug-gesting extensive recycling of terrestrial water. The third province constitutes the Great Basin, characterized by the lack of significant hydrogen characterized by the lack of significant hydrogen isotope variation of groundwater, is thought to be an isotopically closed system. The quantity of water crossing the coast calculated from a model that incorporates the Rayleigh distillation equation is approximately equal to the quantity of precipitation along the Northert California part of the transect studied. This illustrates the importance of evapotranspiration in the terrestrial water budget, as well as the dependency of infand areas on the eastward flux of recycled terrestrial water. (Author's abstract) thor's abstract) W87-00162

USING RADAR FOR GROUNDWATER INVES-TIGATION, Florida Univ., Gainesville. Dept. of Agricultural

For primary bibliographic entry see Field 7B. W87-00196

HYDROGEOLOGIC COMPARISON OF AN ACIDIC-LAKE BASIN WITH A NEUTRAL-LAKE BASIN IN THE WEST-CENTRAL ADIRONDACK MOUNTAINS, NEW YORK, Geological Survey, Atlanta, GA. Water Res Div.

For primary bibliographic entry see Field 5B. W87-00343

MODELLING OF THE TRANSPORT OF CHLORINATED HYDROCARBON SOLVENTS IN GROUNDWATER: A CASE STUDY, Stuttgart Univ. (Germany, F.R.). Inst. fuer Was For primary bibliographic entry see Field 5B. W87-00421

ALTERATION OF THE GROUNDWATER THERMAL REGIME CAUSED BY ADVEC-

atur, Tsukuba Univ. (Japan). Inst. of Geoscience. I. Kayane, M. Taniguchi, and K. Sanjo. Hydrological Sciences Journal HSJODN, Vol. 30, No. 3, p 343-360, September 1985. 7 fig, 13 ref, Ministry of Education, Science and Culture (Japan) Grant No. 57580153.

Descriptors: *Groundwater basins, *Thermal properties, *Observation wells, *Advection, *Groundwater movement, Seasonal variation, Aquifer characteristics, Japan, Water table, Mathematical analysis, Shinano River, Geohydrology, Temperature, Flow profile.

A case study of the Nagaoka Plain of Japan was conducted to demonstrate the importance of temperature in a regional groundwater survey. Groundwater temperatures were measured in observation wells. Seasonal changes in temperature depth profiles showing advective effects horizonally from the Shinano River and vertically from upper and lower aquifers were observed. The temperature depth profiles were classified into six types. Distribution of these types does not contradict the regional structure of the groundwater flow system. The method described is appropriate for a field study in an uninstrumented groundwater basin. (Michael-PTT)

GROUND-WATER FLOW IN THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA, Geological Survey, Columbia, SC. Water Resources Div.

W. R. Aucott, and G. K. Speiran. Groundwater GRWAAP, Vol. 23, No. 6, p 736-745, November-December 1985. 9 fig, 3 tab, 26 ref.

Descriptors: *Aquifers, *Groundwater movement, *Water level fluctuations, *Aquifer characteristics, Aquifer testing, Aquifer systems, Surface-groundwater relations, Geohydrology, Geological sur-

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The U.S. Geological Survey conducted a series of investigations of aquifers throughout the United States as a part of the Regional Aquifer System Analysis program. The Coastal Plain aquifers are recharged primarily by precipitation in their outcrop areas. Groundwater flows from these areas of recharge, through the aquifers, and discharges to upper Coastal Plain rivers, overlying aquifers as upward leakage, and wells. Groundwater flow in the Floridan aquifer system and the Tertiary sand aquifer prior to development is generally perpendicular to the coast. Predevelopment flow in the Cretaceous aquifers, however, turns northeastward as it approaches the coast, almost paralleling the coast. The change in flow is caused by less effective intervening confining units, the aquifers being closer to the land surface, and the rivers at lower altitudes farther upstream in the vicinity of the closer to the land surface, and the rivers at lower altitudes farther upstream in the vicinity of the North Carolina/South Carolina State line. Water level declines in the Cretaceous aquifers occur throughout much of the eastern part of the Coastal Plain of South Carolina due to pumpage in the Myrtle Beach and Florence areas. Large areally extensive water level declines occur also in the Floridan aquifer system in South Carolina due to pumpage in the Savannah, Georgia area. (Geiger-PTT) W87-00512

SUBDIVISION OF THICK SEDIMENTARY UNITS INTO LAYERS FOR SIMULATION OF

GROUND WATER FLOW, Geological Survey, Austin, TX. Water Resources Div

J. S. Weiss, and A. K. Williamson. Groundwater GRWAAP, Vol. 23, No. 6, p 767-774, November-December 1985. 12 fig, 11 ref.

Descriptors: *Geohydrology, *Groundwater movement, *Simulation analysis, *Sedimentary pe-trology, *Sedimentary structures, Hydraulic gradi-ent, Model studies, Hydraulic permeability, Bore-hole geophysics, Boreholes, Hydraulic models.

Subdividing thick sedimentary units into model layers based solely on stratigraphy can lead to serious violations of groundwater flow modeling serious violations of groundwater flow modeling restraints and produce erroneous results. Borehole geophysical data can be used to suggest relative permeabilities and delineate model layers that are more likely to have uniform hydraulic properties than layers delineated by stratigraphic definitions alone. The uniformity within layers emphasizes the permeability contrast between layers, thereby allowing a quasi three-dimensional approach. Sedimentary units containing many thin beds of limited areal extent must be subdivided into model layers which incorporate large variations in hydraulic areal extent must be subdivided into model layers which incorporate large variations in hydraulic properties. The lack of permeability contrast between layers requires a fully three-dimensional approach. In this case, the subdivision into layers needs to be made by including an evaluation of depths of producing zones, and the resultant vertical distribution of hydraulic heads. Nonlinear vertical hydraulic head gradients can occur in thick sedimentary units due to uneven vertical distribution of pumpage and small vertical permeabilities. Because these hydraulic-head gradients are not modeled within a layer, the subdivisions should be made such that the model layers permit simulation of vertical hydraulic-head gradients which can closely approximate observed gradients. These methods are applied to the thick sedimentary units of the Gulf Coastal Plain, U.S.A. (A uthor's abstract) stract) W87-00513

EVALUATING THE HYDRAULIC EFFECTS OF CHANGES IN AQUIFER ELEVATION USING CURVILINEAR COORDINATES, Geological Survey, Lakewood, CO. Water Re-BOURCES DIV.

E. Weiss.
Journal of Hydrology JHYDA7, Vol. 81, No. 3/4, p 253-275, November 15, 1985. 8 fig, 11 ref,

Descriptors: *Groundwater movement, *Ground-water levels, *Groundwater flow equation, *Finite difference methods, *Hydraulic head, *Permeabil-ity coefficient, *Horizontal aquifers, *Folded

strata, Mathematical studies, Curvilinear coordinates, Simulation.

nates, Simulation.

The groundwater flow equation is written in curvilinear coordinates whose coordinate surfaces coincide with the top and bottom surfaces of folded layers of aquifers. The coordinates are general enough for these surfaces to coincide for almost all groundwater systems. The terms of the finite-difference approximation of the flow equation can be separated into two groups: one that corresponds to a similar system of horizontal aquifers and another that corresponds to the folding. The latter group is zero if the vertical gradients in hydraulic head and hydraulic conductivity are zero. Vertical gradients in head must be modeled for the effects of folding to result. With the perturbation method presented here, three-dimensional finite-difference models can be modified to simulate folded aquifer systems with dips as large as 30 degrees, horizontal hydraulic head gradients up to 0.05, vertical hydraulic head gradients up to 0.05, vertical hydraulic head gradients as large as 0.23, and interaquifer hydraulic conductivity differences of two orders of magnitude. For these systems, elevation changes cause only small changes in flow pattern and head distribution from those of similar horizontal systems. (Rochester-PTT) tems. (Rochester-PTT) W87-00583

CONTROLS ON SILICA IN GROUNDWATER ENVIRONMENTS IN THE UNITED KING-

Birmingham Univ. (England). Dept. of Geological

Journal of Hydrology JHYDA7, Vol. 81, No. 3/4, p 277-295, November 15, 1985. 8 fig, 4 tab, 18 ref.

Descriptors: *Silica, *Groundwater, *Aquifer, *Chalk, *United Kingdom, Water chemistry, Recharge, Silicate minerals.

The nature and behavior of silica was nvestigated in the shallow groundwaters of the United Kingdom. Silica concentrations in British groundwaters range up to 30 mg/l SiO2, with an input level in recharge waters of 5 mg/l SiO2. The input concentration is derived from hydrolysis of silicates and tration is derived from hydrolysis of silicates and the solution of siliceous minerals within the soil zone. Development of the observed silica levels in British groundwaters reflects the degree to which reactions between groundwater and silicate minerals in the aquifer matrix are allowed to take place. The final concentration is attained when the groundwater reaches equilibrium with the least stable silicate. This is illustrated with details from the chalk aquifer of Lincolnshire. Silica concentrations are conservative and may be diagnostic of groundwater bodies; variations of a few mg/l may be regarded as significant. (Author's abstract) W87-00584

EXPERIMENTAL STUDIES IN NATURAL GROUNDWATER-RECHARGE DYNAMICS: THE ANALYSIS OF OBSERVED RECHARGE

EVENIS, Kansas State Geological Survey, Lawrence. M. Sophocleous, and C. A. Perry. Journal of Hydrology JHYDA7, Vol. 81, No. 3/4, p 297-332, November 15, 1985. 17 fig. 2 tab, 28 ref.

Descriptors: "Natural recharge, "Precipitation, "Antecedent moisture, "Unsaturated zone, "Eva-potranspiration, "Instrumentation, "Soil water, "Soil temperature, "Water-table hydrographs, Sand dunes, Kansas, Seasonal distribution."

The amounts and time distribution of groundwater The amounts and time distribution of groundwater recharge from precipitation over an approximately 19-month period were investigated at two instrumented sites in south-central Kansas. Precipitation and evapotranspiration sequences, soil-moisture profiles and storage changes, water fluxes in the unsaturated zone and hydraulic gradients in the saturated zone at various depths, soil temperatures, water-table hydrographs, and water-level changes in nearby wells clearly depict the recharge process. Antecedent moisture conditions and the thickness and nature of the unsaturated zone were found to be the major factors affecting recharge. Although

the two instrumented sites were located in sand-dune environments in areas characterized by shal-low water table and subhumid continental climate, a significant difference was observed in the esti-mated effective recharge. The estimates ranged from less than 2.5 to approximately 154 mm at the two sites from February to June, 1983. The main reasons for this large difference in recharge esti-mates were the greater thickness of the unsaturated zone and the lower moisture content in that conmaces were the greater thickness of the unsaturated zone and the lower moisture content in that zone resulting from lower precipitation and higher po-tential evapotranspiration for one of the sites. Ef-fective recharge took place only during late winter and spring. No summer or fall recharge was ob-served at either site during the study. (Author's abstract) abstract) W87-00585

RESEARCH ON THE UNITY OF KARSTIC AQ-UIFER SYSTEMS AFTER EXAMPLES OF HELLENIC KARST (RECHERCHES SUR L'UNITE DES SYSTEMES AQUIFERES KAR-STIQUES D'APRES DES EXEMPLES DU KARST HELLENIQUE), Thessaloniki Univ., Salonika (Greece). Dept. of Geology and Palaeontology. G. Soulios.

Journal of Hydrology JHYDA7, Vol. 81, No. 3/4, p 333-354, November 15, 1985. 15 fig, 8 tab, 21 ref.

Descriptors: *Karst hydrology, *Hydrograph anal-ysis, *Aquifers, *Greece, *Crete, Springs, Re-charge, Mathematical models, Pumping, Apoke-pos, Kephalari, Korisos, Melitsa, Xervouni, Al-myros, Aghios Nicolaos, Correlation coefficients, Rainfall, Alluvium.

Current definitions of karstic aquifer systems are discussed and several examples from Greece are described. From these cases, correlations between the outflows of neighboring springs are used to test whether or not they belong to the same hydrological system. Examples are given of two outlets with nearly identical response (Aposkepos-Kephalari), outlets with a low correlation coefficient (semi-independent springs, Korisos-Militas), and an intermediate case (Xerovouni). The discharges of one spring, classified according to magnitude and plotted on probability paper, produce a simple graph for Korisos, but a more complicated behavior for two springs in Crete (Almyros spring, Aghios Nicolaos and Almyros spring, Iracilo). Breaks in the latter curves are attributed to spilling over of the tarst reservoir towards other outlets and to recharge by waters from the surroundings. A com-Karst reservoir towards other outlets and to re-charge by waters from the surroundings. A com-parison of cumulative discharges with cumulative rainfall for the Voula system reveals the influence of human activities (pumping from adjacent alluvi-um) since 1975. (Author's abstract)

EXPERIMENTAL AND NUMERICAL STUDY

DE WATER AND SUMERICAL STUDY OF WATER AND SOLUTE INFILTRATION IN LAYERED POROUS MEDIA, Elidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.

F. Stauffer, and T. Dracos.
Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 9-34, April 15, 1986. 24 fig, 3 tab, 22 ref.

Descriptors: *Porous media, *Layers, *Recharge, *Soil water, *Phreatic aquifers, *Groundwater movement, Capillary zone, Sand, Advection,

An experimental and numerical study of flow and transport processes occurring in natural and artificial recharge of phreatic aquifers was conducted that was restricted to two-dimensional flow in a vertical plane and conservative tracers. The investigated porous medium was a horizontally-layered sand packing. Once the infiltration front reached the capillary fringe, the experiments showed a rapid change in the phreatic surface slope and thus a fast increase of the flow rate in the saturated domain. Outflow of the infiltrated solute was observed at much later times. It is shown that this fast response is due to capillary phenomena, ie, to the hysteresis in the soil moisture characteristics, and

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thus depends on the initial conditions in the capillary zone. The solute transport was dominated by advective transport mechanisms, which are strongly influenced by the layering of the sand packing. (Author's abstract)
W87-00632

TRANSVERSE DISPERSION FROM AN ORIGINALLY SHARP FRESH-SALT INTERFACE CAUSED BY SHEAR FLOW, Technische Hogeschool Delft (Netherlands).
G. De Josselin De Jong, and C. J. Van Duijn. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 55-79, April 15, 1986. 11 fig. 15 ref, 3 append.

Descriptors: *Shear flow, *Dispersion, *Molecular diffusion, *Saline water, *Saline soils, Porous media, Differential equations, Mathematical models, Interface, Hydrologic models.

models, Interface, Hydrologic models.

The influence of transversal dispersion and molecular diffusion on the distribution of salt in a plane flow through a homegeneous porous medium was studied. Since the dispersion depends on the velocity and the velocity depends on the distribution of salt (through the specific weight), this is a nonlinear phenomenon; for the flow situation considered, this leads to a differential equation with the character of a nonlinear diffusion. The situation at time (t) = 0 was chosen such that the fresh and salt water were separated by an interface, and each fluid has a constant specific weight, gamma-1 and gamma-2, respectively. For this initial situation, the solution of the nonlinear diffusion equation has the form of a similarity solution, depending only on zeta x aq root of (t), where zeta denotes the local coordinate normal to the original interface plane. Properties of this similarity solution are discussed, including showing how to obtain this solution numerically and interpretation of the mathematical results in terms of their hydrologic significance for a number of worked examples. These examples describe the distribution of salt, as a function of zeta and t, for various flow conditions at the boundaries zeta = + or - infinity. Examples also are given where the molecular diffusion can be disregarded with respect to the transversal dispersion. (Author's abstract) W87-00634 stract) W87-00634

GEOSTATISTICAL ANALYSIS OF GEOELECTRIC ESTIMATES FOR SPECIFIC CAPACITY, Tiszadata Consulting Engineers, Budapest (Hunga-

ry). A. Bardossy, I. Bogardi, and W. E. Kelly. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 81-95, April 15, 1986. 17 fig. 17 ref.

Descriptors: *Geophysical studies, *Electrical studies, Specific capacity, *Areal hydrogeology, *Conductivity, *Wells, *Error, Aquifers, Network design, Microcomputers, Statistics, Prediction.

design, Microcomputers, Statistics, Prediction.

A geostatistical method for predicting the areal distribution of specific capacity from a network of surface resistivity measurements and a limited number of known specific capacities obtained from well performance data is presented. The quality of the prediction is characterized by the standard deviation of the estimation error. The effect of the following main factors can be quantified: the spatial variability of the specific capacity, the number and location of the known specific capacities and resistivity measurements, and the regression error of the relationship between resistivity and specific capacity. The methodology is illustrated by a realistic numerical example where 30 well data and 116 resistivity values are available for a 16 sq km aquifer. In this example the use of resistivity data considerably improves the quality of the prediction despite the relatively 'loose' relationship between resistivity and specific capacity (r = 0.80). The calculation can be performed on a microcomputer, and the methodology can be extended to solve the corresponding network design problem. (Author's abstract) W87-00635

PERTURBATION ANALYSIS OF FLOWS IN A THREE-LAYER CONFINED-UNCONFINED AQUIFER SYSTEM,

Lagos Univ. (Nigeria). Faculty of Engineering. O. Lafe. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 97-105, April 15, 1986. 4 fig. 9 ref.

Descriptors: *Groundwater movement, *Perturba-tion analysis, *Non-linear equations, *Confined aquifers, *Unconfined aquifers, Leakage.

Perturbed solutions of the coupled non-linear equations governing essentially horizontal flows in a rigid, three-layer, confined-unconfined aquifer system were obtained in the form of asymptotic series in the dimensionless leakage parameters of the intervening semi-pervious strata. The uppermost layer is phreatic, whereas the remaining two are semi-confined. The solutions are particularized for the flow towards a fully-penetrating well that is acreened from the bottommost confined aquifer. A numerical example of this case is included. (Author's abstract) W87-00636

INFLUENCE OF THE KARST SPRING SUB-MERGENCE ON THE KARST AQUIFER

Karst Water Research Inst., Trebinje (Yugoslavia). P. Milanovic. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 141-156, April 15, 1986. 8 fig, 3 ref.

Descriptors: *Karst hydrology, *Floods, *Reservoirs, *Perennial springs, *Trebisnjica River, *Dinari karst, Watersheds, Yugoslavia, Tectonics, Hydrogeology, Seismicity.

Consequences of the submergence of the flooding of a large and permanent karst spring zone by construction of Grancarevo Dam on the Trebisnof a large and permanent Karst spring zone by construction of Grancarevo Dam on the Trebisn-jica River, Yugoslavia, are discussed. The construction of the 123-m high dam flooded the spring zone to about 75 m deep. The aquifer zone that discharges through this spring zone formed under complex tectogenetic conditions of the Dinari karst, of which the most prominent structures are overthrusts and reverse faults. The annual average discharge from the spring zone is 80 cu m/sec. To define the influence on the karst aquifer regime of flooding of springs correlative analysis was conducted between the index of previous precipitation, the water level in the reservoir, the underground water level in the immediate vicinity of the spring and in the distant parts of the aquifer, and the inflow to the reservoir. The multiple correlation coefficients obtained show mutual dependence of most of the parameters analyzed. Flooding of springs has had some influence on the hydrologic conditions of the upstream polje and the surface in the immediate tributary area. Also, there is evidence of formation of an underground reservoir in the karst aquifer; it is connected with the downstream aquifers and has some influence on the layout of natural watersheds. Seismicity in the catchment of the spring was induced by flooding the springs and formation of the reservoir. (Rochester-PTT) w87-00638 W87-00638

APPROXIMATION OF SALT-WATER INTER-FACE FLUCTUATION IN AN UNCONFINED COASTAL AQUIFER, Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering.

A. Das Gu Ground W A. Das Gupta. Ground Water GRWAAP, Vol. 23, No. 6, p 783-794, November-December 1985. 12 fig, 9 ref,

Descriptors: *Aquifers, *Groundwater, *Saline water intrusion, Saline water, Unconfined aquifers, Saline aquifers, Coastal aquifers, Model studies, Laplace transforms.

A combination of an analytical model for the free-surface fluctuation and a numerical model for the interface fluctuation has been formulated for tran-sient characteristics of salt-water interface consid-ering four different boundary conditions in the form of exciting functions imposed on the up-stream source of fresh-water supply. The one-di-mensional analytical model has been solved using

Laplace transform, and the theory of residues and the results are expressed in terms of an infinite series and an error function. The numerical model gives the fluctuation of the interface for the known free-surface profile; the interface location at the upstream boundary is specified on the condition that any fluctuation on the water table causes a net flow component in the vertical direction at that ser ion. In comparison with laboratory tests, the method appears to be a reasonable approximation of the fluctuating phenomena for practical applications, except for consideration of time lag for interface response which needs further investigation. (Author's abstract)

REPRESENTATION OF FLOWS TO PARTIAL-LY PENETRATING RIVERS USING GROUND-WATER FLOW MODELS,

University Coll., Cardiff (Wales). Dept. of Civil and Structural Engineering.

Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 341-355, December 30, 1985. 9 fig. 20 ref.

Descriptors: *Groundwater flow, *Surface-groundwater relations, *Groundwater flow models, *Aquifers, *Penetrating rivers, Ground-water movement, Groundwater runoff, Simulation analysis, Wales, River Worfe, Regional analysis, Mathematical analysis.

The numerical simulation of regional groundwater flow using equations which incorporate the Dupuit-Forcheimer assumptions, has been a well established technique. In many aquifer models it was necessary to represent the interaction between the aquifer and one or more rivers where the latter did not fully penetrate the aquifer. Several techniques however are available for representing such situations. A numerical model which represented flows in the vertical and one horizontal dimension was used to obtain accurate estimates of flows to flows in the vertical and one horizontal dimension was used to obtain accurate estimates of flows to partially penetrating rivers of various dimensions. These results were then compared with results which utilized the Dupuit-Forcheimer assumptions. Different methods of calculating C were used. Three methods of representing the flows to partially penetrating rivers in regional groundwater flow models have been tested. Two of them gave accurate results for a wide variety of river shapes. The two successful methods have been tested on a practical problem involving the river Worfe (Wales) and gave good results. (Khumbatta-PTT) W87-00673

APPROXIMATE METHOD FOR PUMPING TEST ANALYSIS IN NON-PENETRATING WELLS,

Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.

Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 109-118, January 15, 1986. 4 fig. 1 tab, 13 ref.

Descriptors: "Non-penetrating wells, "Pumping tests, "Test wells, "Aquifer characteristics, "Artesian aquifers, "Groundwater studies, Groundwater flow, Aquifers, Groundwater development.

The groundwater potential of a region can be assessed only after the determination of the two important aquifer parameters known as the storage coefficient and transmissivity. The majority of the currently used analytical solutions of the groundwater movement are based on fully or partially penetrating abstraction wells with at least one observation well. At the preliminary stages, it is economically suitable to have nonpenetrating wells in confined aquifers instead of fully or partially penetrating wells to obtain pumping test data for determining the aquifer parameters. The unsteady flow to a non-penetrating well in a confined aquifer with active well storage has been presented. This requires pumping test data for the non-penetrating well itself. An approximate solution has been obtained for the pumping test analysis in a finite diameter nonepenetrating well discharging at a constant rate from a homogeneous, isotropic and

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extensively thick artesian aquifer. The well storage has been taken into account. A set of type curves has been developed for determining the specific storage and the hydraulic conductivity of the aquifer. The type-curve equation has been obtained on the basis of the water balance and Darcy's equations. The well storage has been taken into account in derivations of the type-curve expressions. The aquifer parameters could be obtained after a matching procedure of the field data with those of the curves. (Khumbatta-PTT)

QUANTITATIVE ANALYSIS OF SALTWATER-FRESHWATER RELATIONSHIPS IN GROUNDWATER SYSTEMS-A HISTORICAL PERSPECTIVE.

Geological Survey, Reston, VA.
T. E. Reilly, and A. S. Goodman.
Journal of Hydrology JHYDA7, Vol. 80, No. 1/2, p 125-160, September 15, 1985. 9 fig. 5 tab, 287 ref.

Descriptors: *Saline water intrusion, *Groundwater, *Saltwater, *Freshwater, *Subsurface water, Density, Advection, Dispersion, Saline water, Mathematical models, Saltwater-freshwater inter-

Although much progress has been made towards the mathematical description of saltwater-freshwater relationships in groundwater systems, the advective and dispersive mechanisms involved are still incompletely understood. Major historical advances are documented and the major directions of current studies are summarized. Density is important in mathematically describing saltwater-freshwater systems. Other mechanisms, such as hydrodynamic dispersion, have not yet been fully understood. Quantitative analysis of a saltwater-freshwater system at them in the protect of the physical system and the important mechanisms using reasonable simplifications and assumptions. Simulation methods have allowed theories to be tested and revised, thereby improving our understanding of the physical processes. Work on the dispersion phenomenon continues and may soon clarify the differences between the advection-dominant systems (where the immiscible approach is appropriate) and dispersive-dominant systems (where the miscible approach is required). The ability to understand quantitatively and describe the relationship between saltwater and freahwater in groundwater systems is necessary to efficiently use the available groundwater resources. (Khumbatta-PITT) batta-PTT) W87-00675

COMPLETING MISSING GROUNDWATER OBSERVATIONS BY INTERPOLATION, Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.

A. Dax.

Journal of Hydrology JHYDA7, Vol. 81, No. 3/4, p 375-399, November 15, 1985. 8 tab, 13 ref.

Descriptors: *Groundwater levels, *Mathematical studies, Model studies, Water level, Water level fluctuations, Interpolation, Observation wells, Seasonal variations, Monitoring.

The problem of completing the missing records of an observation well is considered. It is assumed that the water level records were taken once a month during a sufficiently long period in the past such that existing records enable us to constitute an adequate model. It is also assumed that each year is composed of two seasons, a rainy one and a dry one, the water levels are monotonically increasing during the rainy season and decreasing during the dry season. Hence it is desired that the computed water levels will follow this seasonal pattern. A simple interpolation method for automatic reconstruction of the missing observations is presented. The only information which is needed by the proposed algorithm is the series of the recorded water levels and a suitable model for this series. The model can be viewed as a modified version of the classical interpolation method described earlier by Friedman. The main difference is that here the related series is generated by the enclosed model. related series is generated by the enclosed model.

A further difference is that the interpolation rule is

modified to make sure the seasonal monotony of the water levels is not violated. (Author's abstract)

GROUNDWATER MANAGEMENT BY CHANCE-CONSTRAINED MODEL, Wyoming Univ., Laramie. Water Resources Research Inst. For primary bibliographic entry see Field 4B. W87-00736

MODELING TWO-WELL SYSTEM IN A STRATIFIED AQUIFER,
State Univ. of New York at Buffalo. Dept. of Civil State Univ. of view Land E. M. Laursen. E. Fukumori, A. Wake, and E. M. Laursen. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 1, p 129-141, January 1986. 10 fig, 1 tab, 13 ref.

Descriptors: *Groundwater movement, *Aquifers, *Model studies, *Stratified aquifers, Mathematical studies, Mathematical models, Flow characteristics, Wells, Pump wells, Finite element methods, Boundary element methods.

The Dupuit theory, an often-used simplification for aquifer analyses, has been found to be a good approximation for the two-well system symmetrically imaged about the hydrostatic interface for the approximation for the two-well system symmetrically imaged about the hydrostatic interface for the region far from the well. For nonsymmetrically imaged well systems, the Dupuit approximation is no longer applicable. A mathematical method and computational methods were developed for the flow behavior analysis of a stratified aquifer in response to simultaneous pumping of two fluids from both sides of the interface. A typical application may be found in coastal aquifers for suppressing the salinity upconing often encountered by single well pumping. Using two numerical methods, the boundary element method and the finite element method, two-dimensional steady state conditions were simulated for the two-well system. As evidenced by the physical model studies, the results of the computational experiments suggest that the two-well system could increase the fresh water yield up to ten times the maximum yield for the single-well system. The feasibility of practical field applications seems quite promising. (Author's abstract) stract) W87-00744

OPTIMAL CONTROL MODEL FOR GROUND-WATER MANAGEMENT, Sutron Corp., Herndon, VA. For primary bibliographic entry see Field 4B. W87-0074

HYDROGEOCHEMISTRY, CONTAMINANT TRANSPORT AND TECTONIC EFFECTS IN THE OKPOSI-UBURU SALT LAKE AREA OF IMO STATE, NIGERIA, Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W87-00775

RELATION BETWEEN HYDRAULIC TRANS-MISSIVITY AND TRANSVERSE RESISTANCE IN A COMPLICATED AQUIFER OF GLACIAL OUTWASH DEPOSITS, Rhode Island Univ., Kingston. Dept. of Geology. R. K. Frohlich, and W. E. Kelly. Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 215-229, July 30, 1985. 8 fig, 1 tab, 16 ref. NSF Grant 7819408.

Descriptors: *Hydraulic transmissivity, *Transverse resistance, *Aquifers, *Glacial aquifers, *Glacial drift, *Groundwater movement, Water depth, Geoelectrical depth soundings, Hydraulics, Particle size, Moraines.

Geological depth soundings were conducted over aquifers in glacial outwash deposits near a reces-sional moraine in southern New England. Lateral as well as vertical changes in lithology present a complicated system of a multistory aquifer. In

most cases, the aquifer could be identified with an intermediate resistivity between that of the unsaturated zone and the fine-grained aquitard. Results of the depth soundings were compared with test wells and pumping tests. Comparison of the ranges of hydraulic transmissivities with the transverse resistance shows a linear relationship between both values. This suggests that even in complicated cases, where test wells are of limited use, the geoelectrical depth sounding method can be used to locate aquifers of high hydraulic transmissivity. Great care is necessary to measure reliably the water resistivity in the test well. A further uncertainty is the depth of the filter screen relative to the bottom of the aquifer. The transverse resistance is a more characteristic integral electrical parameter than is the layer resistivity. This may explain why it shows a more reliable relationship with the hydraulic transmissivity in a complicated case than does the relationship between formation factor and hydraulic conductivity, which was found in simple cases. (Doria-PTT) W87-00780

HYDROLOGICAL AND HYDROGEOCHEMI-CAL METHODS FOR THE DELINEATION OF COMPLEX GROUNDWATER FLOW SYSTEMS EVIDENCED IN THE BET-SHEAN AS EVIDENCED VALLEY, ISRAEL,

Ministry of Agriculture, Jerusalem (Israel). Hydrological Service. E. Rosenthal, and S. Mandel.

Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 231-260, July 30, 1985. 6 fig, 8 tab, 20 ref.

Descriptors: "Hydrology, "Geochemistry, "Groundwater movement, "Israel, "Groundwater, Flow, Aquifers, Drainage, Subsurface drainage, Water resources development, Wells.

The Bet-Shean Valley (Northern Israel) is the bas The Bet-Shean Valley (Northern Israel) is the base level of groundwater draining from three regional aquifers. In the natural undisturbed state at the beginning of the sixties, groundwater drained through many springs with widely different chemical composition and with a total discharge of about 135 million cu m. For the efficient utilization of water resources, it was decided to recover groundwater from wells at the cost of a considerable reduction of spring discharges. Since the sequence and the rate of spring-decay diverged from the pattern that had been predicted, it became necessary to delineate aquifers and their connections to the various springs. The springs of Bet-Shean clussary to delineate aquifers and their connections to the various springs. The springs of Bet-Shean cluster into two distinct internally correlated groups: The Gilboa and the Mid-Valley Groups. The main hydrological event in the area was the initiation of groundwater exploitation from the Revaya well field in 1961. Three major groundwater flow paths extending between the natural outlets of the regional aquifers and the springs were delineated: (1) the Gilboa line extending northwards along the eastern margin of Mt. Gilboa; (2) the Bezeq-Hisha and Bardala-Zapoah line connecting the mountain with segments of the Mid-Valley line; and (3) the Bardala-Succoth path draining groundwater south-eastwards. En Huga and Hassida play the role of terminal springs at the northern end of the Mid-Valley in Delay curve analysis is a reliable tool for elucidation of relations between aquifers and springflow. Cumulative flow curves are useful for elucidation of relations between aquifers and springflow. Cumulative flow curves are useful during the early exploitation phase of a regional aquifer system. Time-lag regression is valuable for clarifying the connection between aquifers and springs which are frequently at variance with preconceived notions. Under some conditions, spring discharge/rainfall ratios may give widely scattered results which should not be disregarded but used as a starting point for more detailed investigation. (Doris-PTT) W87_00781

HORIZONTAL AND VERTICAL COMPONENTS OF FLOW DEDUCED FROM GROUNDWATER HEADS,

Birmingham Univ. (England). Dept. of Civil Engi-

K. R. Rushton, and K. S. Rathod. Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 261-278, July 30, 1985. 7 fig, 1 tab, 7 ref.

Water In Soils—Group 2G

Descriptors: *Flow, *Groundwater, *Groundwater movement, *Velocity head, Aquifers, Hydraulics, Permeability coefficient, Groundwater development, Vertical flow, Mathematical studies.

Even though the groundwater head remains constant with depth, it is possible to estimate both the vertical and horizontal flow components from the groundwater-head distribution. The accuracy of these calculated flow components can be assessed by compering with results obtained from solutions in terms of the groundwater potential which is a function of both horizontal and vertical coordinates. Examples considered include confined and unconfined aquifers, aquifers having a sloping base and time-variant behavior. A study of an aquifer with a horizontal band of lower hydraulic conductivity shows that in this situation the groundwaterhead approximation may not be acceptable. (Author's abstract)

DOES THE REGIONAL GROUNDWATER-FLOW EQUATION MODEL VERTICAL FLOW, Thames Water Authority, Reading (England). Di-rectorate of Engineering.

Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 279-299, July 30, 1985. 3 fig, 5 tab, 9 ref.

Descriptors: *Groundwater movement, *Model studies, *Vertical flow, *Aquifers, *Regional flow, *Mathematical studies, Groundwater development, Flow, Hydraulics.

It is commonly assumed that the average-head solution as obtained from the partial differential equation describing regional groundwater flow (conventional governing equation) ignores vertical flow within the main body of the aquifer. At cal flow within the main body of the aquifer. At first sight, this assumption appears to be well-founded, since the derivation of the conventional governing equation embraces the Dupuit assump-tions which assume regional flow to be essentially horizontal. However, not only is vertical flow inherently implied within the conventional govern-ing equation, but much useful information on the distribution of vertical flow over the saturated death can be obtained from the average need soludistribution of vertical flow over the saturated depth can be obtained from the average head solution. The proof is provided by deriving the conventional governing equation from an exact and generalized form of the regional-flow equation. The mathematical procedure for deriving these equations is actually similar to that given elsewhere by Bear and others but differs in its retention of associated error terms and its adherence to tion of associated error terms and its adherence to tion of associated error terms and its adherence to ouing specific discharge, and not head, as the de-pendent variable. Expressions are presented for the exact and approximate vertical flow components at an arbitrary point over the saturated depth. A simple regional-flow problem is analyzed numeri-cally to demonstrate these points. (Author's abstract) W87-00783

IN SEARCH OF A CHARACTERISTIC SIGNATURE FOR GROUNDWATER AQUIFERS - A

TURE FOR GROUNDWATER AQUIFERS - A CASE STUDY FROM ISRAEL, Flinders Univ. of South Australia, Bedford Park. School of Earth Sciences.
L. M. Ramamurthy, and J. W. Holmes.
Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 389-400, July 30, 1985. 7 fig, 2 tab, 13 ref.

Descriptors: *Israel, *Groundwater, *Aquifers, *Chemical properties, *Radioactive tracers, *Uranium radioisotopes, Hydrology, Geochemistry, Water properties.

The uranium isotopic and hydrogeochemical data of groundwaters in the Galilee, Betshean, Samaria, and Beersheva regions of Israel, obtained from the and Beersheva regions of Israel, obtained from the published literature, have been re-interpreted according to new ideas gained from a study of uranium concentrations in groundwaters in Australia. In general, the uranium concentration of natural waters seems to be proportional to the HCO36-concentration in a way that is characteristic of individual aquifers. In the Israeli context, the major limestone and basaltic aquifers can be clearly distinguished, even to the extent of the mixing of

waters from these two sources. The limitations of tracing groundwater bodies by the 234-U/238-U activity ratios vs. U-concentration plot are discussed, and the need for interpreting uranium isotopic data in conjunction with hydrogeochemical data is demonstrated, which suggests that some of the earlier published inferences could be reconsidered. The HCO3 vs. U correlation technique appears to be a good technique for tracing and delineating groundwater bodies in an oxidizing environment, irrespective of their size, residence time, and conditions at the time of recharge. (Author's abstract) stract) W87-00788

THORNTHWAITE-MATHER PROCEDURE AS A SIMPLE ENGINEERING METHOD TO PREDICT RECHARGE, New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering

ing.
T. S. Steenhuis, and W. H. Van Der Molen.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4,
p 221-229, May 30, 1986. 2 fig. 1 tab, 11 ref.

Descriptors: *Thornthwaite-Mather procedure, *Groundwater recharge, *Soil moisture balance, *Unsaturated zone, *Percolation, Long Ialand, New York, Cost analysis, Direct measurement.

The Thornthwaite-Mather (T-M) procedure for calculating recharge from the soil moisture balance was extended to use daily input values and to include the delay caused by percolation through the unsaturated zone. The proposed method has been checked against measurements obtained on Long Island, New York, and proved to give fairly good results. For recharge predictions where both the amount of recharge is bounded upwards by the amount of precipitation and the experimental measurement method needs further refinement, the T-M procedure seems to be a very attractive and economic procedure and economic procedure seems to be a very attractive and economic procedure procedure seems to be a very attractive and eco-nomical alternative to direct measurement. (Rochester-PTT) W87-00811

GROUNDWATER FLOW INTO LAKE MICHI-GAN FROM WISCONSIN, Wisconsin Univ.-Milwaukee. Dept. of Geological

For primary bibliographic entry see Field 2A. W87-00813

LAYERED AQUIFER MODEL OF ATOLL ISLAND HYDROLOGY: VALIDATION OF A COMPUTER SIMULATION, Nevada Univ. System, Reno. Desert Research Inst. M. E. Herman, R. W. Buddemeier, and S. W.

Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 303-322, May 30, 1986. 8 fig, 1 tab, 30 ref, append. DOE Contract W-7405-ENG-48.

Descriptors: *Finite element models, *Atolls, *Islands, *Hydrology, *Groundwater movement, *Aquifers, FEMWATER, Holocene, Dupuit assumptions, Pliocene, Pleistocene, Enewetak Atoll, Lagoons, Hydraulic head, Enjebi Island, Reefs, Simulation analysis, Permeability coefficient, Communication of the communi puter programs

The finite-element model FEMWATER was used to simulate groundwater movement in the two-dimensional vertical plane of an atoll island section. The model island had dimensions consistent with Enjebi Island (Enewetak Atoll), a surficial (Holocene) aquifer to a depth of 15 m with hydraulic conductivity = 0.0069 m/sec, overlying a Plio-Pleistocene aquifer with hydraulic conductivity tensor = 0.0069 m/sec. A tidally-varying water level was applied to the ocean and lagoon boundaries, and the model was run until pseudo steady-state conditions were achieved in the groundwater variations. Hydraulic head contours in the vertical section demonstrate that water motion under the supratidal portion of the island is almost exclusively vertical. Calculated water table tidal lags and efficiencies are in excellent agreement with measured values from shallow wells on Enjebi Island, confirming the validity of the layered aquifer

model and the approximate magnitudes of the hydraulic conductivities. The results emphasize the potential importance of tidal effects and vertical water flow on reef island groundwater systems, and cast doubt on the utility of traditional models using the Dupuit assumptions of essentially horizontal flow. (Author's abstract)
W87-00816

STEADY GROUNDWATER FLOW FROM CONSTANT HEAD RECHARGE WELLS IN SEMI-CONFINED AQUIFERS, Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering. S. K. Shakya, and S. R. Singh, Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 323-332, May 30, 1986. 1 fig, 2 tab, 13 ref.

Descriptors: *Groundwater movement, *Recharge wells, *Semi-confined aquifers, Well screens, Mathematical equations, Recharge rate, Piezometric head distribution, Hydraulic head, Constanthead wells, Boundary conditions.

Solutions were developed for the steady ground-water flow from a well installed in two leaky confined squifers. Three cases of placing the well screens in the aquifers were analyzed (in the upper aquifer, in the lower aquifer, and in both aquifers). The head in the manhole was considered constant and the Dirichlet-Neumann type of boundary conditions were specified at the well-aquifer interface. Equations for the recharge rate and piezometric head distribution were developed. A sample computation is performed. Although the present solutions were developed for constant-head recharge wells, they could be used for constant-head discharge wells. (Rochester-PTT) W87-00817

REVIEW OF THE FACTORS AFFECTING THE DEVELOPMENT OF GHYBEN-HERIZBERG LENSES IN THE BAHAMAS, Ministry of Works and Utilities, Nassau (The Bahamas). Family Island Div. R. V. Cant, and P. S. Weech. Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 333-343, May 30, 1986. 3 fig. 5 tab, 5 ref.

Descriptors: *Bahamas, *Ghyben-Hertzberg lenses, *Freshwater, Rainfall, Geology, Limes-tones, Permeability, Rock properties, Islands, Sand, Permeability coefficient, Hydraulic conduc-

The occurrence of freshwater in the Bahamas is summarized and the way lens development is controlled by the size and shape of the islands and by rainfall and geology is described. Rainfall is the source of all freshwater in the Ghyben-Hertzberg lenses of the Bahamas, and the amount of rainfall, along with geological constraints, determines the size and extent of the lenses. Generally, the largest and more extensive lenses form on the islands with rainfall in excess of 1,150 mm/yr and where the broadest portion of the island is oriented along an east to west axis. In addition to these controls, the major geological constraint on lens development is the age of the limestones in which the freshwater bodies occur. Older limestones have more conductive hydraulic systems, which tend to reduce the retention of freshwater. Rock permeabilities are so critical to lens development in the Bahamas that lens formation could be said to be more the result of rock and sand entrapment of water than the basic Ghyben-Hertzberg principle itself. (Rochester-PTT) ter-PTT) W87-00818

2G. Water In Soils

TROPICAL ORGANIC SOILS ECOSYSTEMS IN RELATION TO REGIONAL WATER RE-SOURCES IN SOUTHEAST ASIA, Butler Univ., Indianapolis, IN. Holcomb Research

Inst.
T. V. Armentano.
Available from the National Technical Information
Service, Springfield, VA. 22161, as DE83-000994,

Group 2G-Water In Soils

Price codes: A02 in paper copy, A01 in microfiche. Report No. DOE/EV/10725-3, 1982. 17 p, 42 ref. Contract No. DE-AC02-81EV10725.

Descriptors: *Organic soils, *Soil ecosystem, *Water resources, *Southeast Asia, *Tropical re-gions, *Water quality, Sinks, Carbon, Nitrogen, Sulfur, Nutrients, Peat bogs, Oligotrophic forests, Organic compounds, Cation exchange, Vegetation, Drainage, Eutrophication, Phosphorus.

Tropical organic soils have functioned as natural sinks for carbon, nitrogen, sulfur and other nutrients for the past 4000 years or more. Topographic greaters to the past 4000 years or more topographic greaters. ents for the past 4000 years or more. Topographic evolution in peat swamp forests towards greater oligotrophy has concentrated storage of the limited nutrient stock in surface soils and biota. Tropical peat systems thus share common ecosystem characteristics with northern peat bogs and certain tropical oligotrophic forests. Organic matter accumulation and high cation-exchange-capacity, limit nutrient exports from undisturbed organic soils, although nutrient restation declines with increasing eutrophy and wetland productivity. Peat swamps are subject to irreversible degradation if severely altered because disturbance of vegetation, surface peats and detritus can disrupt nutrient cycles and reduce forest recovery capacity. Drainage also greatly increases exports of nitrogen, phosphorus and other nutrients and leads to downstream eutrophication and water quality degradastream eutrophication and water quality degradation. Regional planning for clean water supplies must recognize the benefits provided by natural peatlands in balancing water supplies and regulating water chemistry. (Author's abstract)

SOIL DYNAMICS AND THE PRODUCTIVITY OF SPARTINA ALTERNIFLORA, Georgia Univ., Sapelo Island. Marine Inst.

Octoring Univ., ospero Issain. Annual Issain.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 231-242, 3 fig. 1 tab, 49 ref. EPA Grant No. R806592-01.

Descriptors: *Soil dynamics, *Spartina alterniflora, *Productivity, Interstitial water, Salinity, Tidal floods, Nitrogen, Oxygenation, Elevation, Rhizos-

The striking heterogeneity in standing stock and productivity of Spartina alterniflora has been explained in a number of ways. Elevation, interstitial salinity, tidal inundation, nitrogen availability and oxygenation of the root zone have each been suggested as the key variable. In fact, there is a great deal of interaction between them. The relationship between elevation and tidal inundation is obvious; both can influence soil salinity. Both salinity and both can influence soil salinity. Both salinity and both can influence soil salinity. Both salinity and rhizosphere oxygeneration can affect nitrogen uptake. There can be a positive feedback between productivity and rhizosphere oxygenation and, conversely, a negative feedback between productivity and soil salinity. Increasing subsurface drainage in an intermediate-height S. alterniflora zone can result in increased aboveground growth and can also produce soil conditions similar to those found in the low marsh. No single soil characteristic appears to control S. alterniflora productivity; rather, a complex of factors of all affected by subsurface drainage. (See also W87-00005) (Author's abstract) thor's abstract)

SCIENTIFIC AND TECHNICAL ASPECTS OF THE HYDROLOGY OF HUMID ZONES IN CENTRAL AFRICA (ASPECTS SCIENTIFI-QUES ET TECHNIQUES DE L'HYDROLOGIE DES ZONES HUMIDES DE L'AFRIQUE CEN-TRALE),

For primary bibliographic entry see Field 2A. W87-00094

SOIL MOISTURE REGIMES AS AFFECTED BY SILVICULTURAL TREATMENTS IN HUMID EAST TEXAS, Stephen F. Austin State Univ., Nacogdoches, TX.

M. Chang, J. C. Ting, K. L. Wong, and E. V. Hunt.

Hunt.

IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg. West Germany, August 15-27, 1983. p
175-186, 3 fig. 3 tab, 18 ref.

Descriptors: *Soil water, *Silviculture, *Texas, *Humid areas, Cultivation, Soil moisture deficiency, Statistical analysis, Model studies, Surface runoff, Soil erosion, Rainfall.

Based on 268 observations, average soil moisture content generally increases with depth, and with treatments in this order: undisturbed forest, thinned, clearcutting without site preparation, clearcut and KG bladed, clearcut and chopped, antiqueted Differences in the mean soil moisand cultivated. Differences in the mean soil ture content between cultivated and undistr ture content between cultivated and undisturbed forest plots were as great as 0.20 g/cu cm. Fluctuations are greater near the ground surface, in the growing season, and on plots with greater forest cover and less site disturbance. Eight of ten depletion models gave estimates of soil moisture content at 30 cm and 0-120 cm depths for the six treatments with fair accuracy and reasonable results. The most desirable model estimates moisture contents with P(2) greater then 0.05 and texteded excepts. most desirable model estimates moisture contents with R(2) greater than 0.95 and standard error of estimates less than 5% of the observed mean (where R(2) are the coefficients of multiple determination). The depletion rate is generally greater when soil moisture content is high, near the ground surface, on forest plots, and during the growing season. Surface runoff and soil losses of the six silvicultural treatments are associated with the six sirvicultural treatments are associated white soil moisture content. About 8, 10, 10, 21, 31 and 40% of net storm rainfall, in the above order, occurred as surface runoff; and storms with gross rainfall more than 16.9, 10.0, 4.6, 3.8, 3.4 and 6.5 mm were required to generate surface runoff on these East Texas sites under the six treatments listed above. (See also W87-00086) (Author's abstract) W87-00099

LACK OF DEPENDENCE OF LOSSES FROM FLOOD RUNOFF ON SOIL AND COVER CHARACTERISTICS,

New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2E.

MOISTURE ADEQUACY IN RELATION TO FORESTRY AND AGRICULTURAL LAND USE IN THE MAHANADI RIVER BASIN,

Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.

A. A. L. Sarma

A. A. L. Sarma.

IN: Hydrology of Humid Tropical Regions, IAHS

Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the

International Union of Geodesy and Geophysics,

Hamburg, West Germany, August 15-27, 1983. p

259-264, 4 fig. 5 ref.

Descriptors: *Soil water, *Forestry, *Land use, *Agriculture, *Mahanadi River, India, Soil moisture retention, Water requirements, Hydrologic budget, Available water.

The moisture that is necessary for the sustenance of a crop or a vegetation species can be best derived from a knowledge of the index of moisture adequacy. In this paper the moisture adequacy concept is extended and applied to the Mahanadi River basin, one of the major rivers in India, by trying to understand the soil moisture availability trying to understand the soil moisture availability and its variation during the four conventional seasons of the year on a macroclimatic scale. Special attention is also paid to the distribution and spatial variation of crops and forest types in view of the present findings. The water balance concept is employed for obtaining the basic parameters of the present study. (See also W87-00086) (Author's abstract') stract)

DYNAMIC MODEL FOR DETERMINATION OF SOIL MOISTURE BUDGET AND ITS AP-PLICATION

Hochschule der Bundeswehr Muenchen, Neubi-

Hochschule der Bundeswehr Muenchen, Neubi-berg (Germany, F.R.). H. -B. Kleeberg, and G. Koplitz-Weissgerber. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Sym-posium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 387-396, 2 fig. 2 tab, 15 ref.

Descriptors: *Dynamic programming, *Soil water, *Soil moisture meters, Hydrologic models, Water use, Irrigation, Infiltration, Groundwater, Mathematical models, Evaporation.

Prediction of soil moisture content is considered important for irrigation timing purpose as well as for precipitation-runoff computations. This paper presents a model for assessment of daily variations for precipitation-runoff computations. This paper presents a model for assessment of daily variations of soil moisture. In terms of water consumption, the model describes evaporation from bare and from cropped soil for which plants are stressed through variable climatic conditions. In terms of water supply, the model describes the infiltrated part of precipitation, as well as irrigation and groundwater contributions. A numerical expres-sion for infiltration that considers ponded and dry sion for infiltration that considers ponded and dry surface conditions, respectively, is used, together with well-established formulae for evaporation. The mathematical model is transformed into a computer program, which enables fast and simple data processing. Required input data consist of generally available climatic measurements and soil water constants. Compared over a two year period, the predicted soil moisture values correspond satisfactorily to the measured values. (See also W87-00086) (Author's abstract)

SOLUTE MOVEMENT IN UNSATURATED SOILS UNDER INTERMITTENT CONDITIONS,

TIONS,
New South Wales Univ., Kensington (Australia).
School of Civil Engineering.
K. K. Watson, and M. J. Jones.
IN: Effects of Water Disposal on Groundwater
and Surface Water, IAHS Publication No. 139,
1982. Proceedings of a Symposium held during the
First Scientific General Assembly of the IAHS at
Exeter, England, July 19-30, 1982. p 79-88, 3 fig,
18 ref.

Descriptors: *Computer models, *Soil water, *Un-saturated flow, Groundwater movement, Mathe-matical studies, Hysteresis, Infiltration, Solute

The significance of computer-based numerical methods in describing solute movement through the unsaturated zone is discussed and an implicit finite difference model of water movement in unsaturated soils is outlined. The inclusion of soil water hysteresis effects when analyzing water movement under a pattern of infiltration-redistribution sequences is discussed and the characteristics of three available hysteresis models are detailed. The development of an explicit finite difference model of solute movement is then described and its use in conjunction with the soil water model explained. The solute model is verified by comparing the numerical results with a quasi-valued hydrodynamic dispersion coefficient. Further verification of the model is then undertaken using experimental data for solute movement under constant concen-The significance of computer-based numerical of the model is then undertaken using experimental data for solute movement under constant concentration conditions. The use of the solute model in simulating solute movement during intermittent water application to the soil surface is described using a sandy loam as the porous material. (See also W87-00127) (Author's abstract) W87-00133

HYDROLOGY OF A SLOPING, STRUCTURED CLAY SOIL AT WYTHAM, NEAR OXFORD, ENGLAND,

Helix Software Consultants, London (England). W. R. Kneale Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 1-14, June 15, 1986. 6 fig, 3 tab, 13 ref.

Descriptors: *Clays, *Soil properties, *Soil water movement, *Hydrologic properties, *Wytham, *England, Hydraulic conductivity, Soil water po-tential, Irrigation, Field tests, Soil porosity.

England, Hydraulic conductivity, Soil water potential, Irrigation, Field tests, Soil porosity.

A structured clay soil at a sloping site in the Wytham catchment near Oxford, England, was examined with the intention of establishing the route followed by water through the soil during rainfall. The hydraulic conductivity/matrix potential relationship for wet soil was measured by the instantaneous profile method in the field, and by steady-state measurements on soil cores. A series of experiments were performed in which controlled irrigation was applied to a field plot and the soil moisture content potential and outflow from a drain at the base of the plot were monitored. Irrigation of the field plot at intensities between 3.6 and 15.6 mm/h prompted a rapid response from the drain at the base of the plot. There was no surface runoff. There was no indication of a rise of the water table into the humus accumulation horizon, with consequent topsoil interflow. The available evidence indicated that rapid flow must have taken place vertically and laterally, probably through a network of open cracks. It was reasonable to assume that flow took place vertically until the macropore-channel water table was reached, and then by lateral flow through a saturated channel network to the drain outlet. This model for infiltration into and through the soil profile is supported by the observations of the undrained profiles at the sites close to the field plot. Once again, the water table fluctuated between 1.2 and 0.2 m during the wet winter period, with no evidence of a perched water table in the plough layer or humus accumulation horizons. The slower water table recession at site 5 compared to site 6 could have been a result of differences in the connectivity of the macropore-channel network, or of differences in the balance between inputs from upslope and outputs downslope. (Lantz-PTT) W87-00151

STUDY OF TRACER MOVEMENT THROUGH UNSATURATED SAND, Vrije Univ., Brussels (Belgium). Lab. of Hydrolo-

gy. F. de Smedt, F. Wauters, and J. Sevilla. Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 169-181, June 15, 1986. 11 fig, 1 tab, 28 ref.

Descriptors: *Environmental tracers, *Sand, *Unsaturated flow, Dispersivity, Flow profile, Tritium, Leaching, Hydrodynamics.

A column of 100 cm length and 15.4 cm diameter was filled with sand. A solute displacement experiment, using tritium as a tracer, was conducted under saturated water flow conditions. Analysis of under saturated water flow conditions. Analysis of the observed effluent concentration resulted in an estimated dispersivity of 0.094 cm. Solute displacement experiments under unsaturated water flow conditions were conducted by leaching the column intermittently on a daily basis with constant amounts of water. As soon as the amount drained from the column was equal to the daily input, tritium was added to the infiltrating water for some period. Three such experiments were conducted with different amounts of water infiltrated daily. These amounts were small enough for the water the product of the pro with different amounts of water infiltrated daily. These amounts were small enough for the water flow to remain unsaturated. Parameters of the hydrodynamic dispersion equation were fitted to the observed effluent concentrations. Very large dispersion coefficients were obtained with a dispersivity of about 7.3 cm. One possible explanation for this phenomenon was the presence of immobile water pockets during unsaturated flow. For all the experiments, it was found that about 36% of the water in the unsaturated column could be considered immobile. The exchange of solutes between the mobile and immobile phases explains very well the large dispersion observed in the experiments conducted under unsaturated conditions. (Author's abstract) abstract)

COMPARATIVE EFFECTS OF PRECIPITA-TION ACIDITY ON THREE FOREST SOILS: CARBON CYCLING RESPONSES,

Maine Univ. at Orono. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W87-00200

GASOLINE RESIDUAL SATURATION IN UN-SATURATED UNIFORM AQUIFER MATERI-ALS, Connecticut Univ., Storrs. Dept. of Civil Engi-

neering.
For primary bibliographic entry see Field 5B.
W87-00225

RAINFALL AND DECOMPOSITION IN THE CHIHUAHUAN DESERT,
New Mexico State Univ., Las Cruces. Dept. of Botany and Entomology.
W. G. Whitford, Y. Steinberger, W. MacKay, L.
W. Parker, and D. Freckman.
Oecologia OECOBX, Vol. 68, No. 4, p 512-515, March 1986. 4 fig. 1 tab. 19 ref. NSF Grant Nos. DEB 8020083 and BSR 821539.

Descriptors: *Rainfall, *Decomposing organiter, *Chihuahuan Desert, *Creosotebi* *Rainfall intensity, Simulated rainfall, https://doi.org/10.1003/2009

The authors tested the hypotheses that rates of decomposition in a desert (New Mexico) should be higher following single large (25 mm) rain events than evenly spaced 6 mm events and that supplemental rainfall should result in higher populations of soil biota. There were no significant differences in mass losses of creosotebush (Larrea tridentata) in mass losses of creosotebush (Larrea tridentata) leaf litter on plots receiving water supplementation and no added water. On some sampling dates, there were higher mass losses in the 6 mm/wk treatment. Weekly rainfall produced higher coefficients of variation in mass losses than the other rainfall regimes. A single event pulse compared with weekly pulses of rainfall during the normal 'dry' period resulted in no differences in mass losses. Microarthropods and nematodes exhibited numerical responses to supplemental rainfall but iosses. Microarthropods and nematodes exhibited numerical responses to supplemental rainfall but the litter microflora did not. These studies provide direct experimental evidence that the conventional wisdom linking decomposition to rainfall in deserts is wrong. The studies also suggest that the effects of litter fauna on surface litter decomposition are minimal; therefore, future studies should focus on the activities of the microflora. (Author's abstract) W87-00234

INFLUENCE OF SUBTERRANEAN TERMITES ON THE HYDROLOGICAL CHARACTERIS-TICS OF A CHIHUAHUAN DESERT ECOSYS-

New Mexico State Univ., Las Cruces. Dept. of Civil Engineering. N. Z. Elkins, G. V. Sabol, T. J. Ward, and W. G.

Ventiord.

Oecologia OECOBX, Vol. 68, No. 4, p 521-528, March 1986. 2 fig, 5 tab, 28 ref. NSF Grant Nos. DEB 8020083 and BSR 821539.

Descriptors: *Infiltration rate, *Runoff rate, *Termites, *Chihuahuan Desert, *Bed-load discharge, *Soil erosion, Soil density, New Mexico, Shrub canopy, Soil water, Simulated rainfall.

canopy, soil water, Simulated rainfall.

Rainfall simulation at an average intensity of 124 mm/hr was used to compare infiltration and runoff on arid areas where subterranean termites had been eliminated 4 yr before (termite free) with adjaccnt areas populated by subterranean termites (termites present). Infiltration rates on termite-free plots with less than 5% perennial plant cover were significantly lower than rates on comparable termites-present plots (51.3 + or - 6.8 mm/hr vs 88.4 + or - 5.6 mm/hr, respectively). On plots centered on Larrea tridentata shrubs, there were no differences in infiltration rates (101 + or - 6 mm/hr). Highest runoff volumes were recorded from termite-free, <5% grass cover plots and the lowest from plots with shrubs. There were no differences in suspended sediment concentrations from termites-present and termite-free plots. Average bed load concentration from

termite-free, <5% cover plots was more than three times greater than from termites-present, <5% cover plots. Subterranean termities are con-sidered by the authors to be essential to maintain-ing the soil water characteristics that support the present vegetation of the Chihushuan desert. (Rochester-PTT) W87-00235

STIMULATION OF METHANOGENESIS BY ALDICARB AND SEVERAL OTHER N-METHYL CARBAMATE PESTICIDES, State Univ. of New York at Stony Brook. Marin Sciences Research Center. For primary bibliographic entry see Field 5B. W87-00257

PREDICTING SALINIZATION AND SODIFICATION OF A BARE SANDY LOAM SOIL AFTER IRRIGATION WITH POOR-QUALITY WATER INTERSPERSED WITH RAIN, Haryana Agricultural Univ., Hissar (India). Dept. of Soils. For primary bibliographic entry see Field 3C. W87-00272

CONCEPTS OF SOLUTE LEACHING IN SOILS: A REVIEW OF MODELLING APPROACHES, Rothamsted Experimental Station, Harpenden (England).

For primary bibliographic entry see Field 5B. W87-00423

TOPOGRAPHIC CONTROLS OF SOIL MOIS-TURE DISTRIBUTIONS. Oxford Univ. (England). Geography School. T. P. Burt, and D. P. Butcher. Journal of Soil Science, Vol. 36, No. 3, p 469-486, September 1985. 10 fig. 1 tab, 27 ref.

Descriptors: *Soil water, Water, Ilygroscopic water, *Topography, Surface runoff, Topographic mapping, Slope gages, Slapton, South Devon, England.

Soil moisture distributions on an instrumented hillslope at Slapton, South Devon, were compared to two topographic indices. The index area/'slope gradient' (a/s) was used in a computer runoff model to predict the location of zones of surface saturation on a hillslope while the index plan curvature was derived from techniques of terrain analysis using gridded altitude data. Neither index is entirely satisfactory for predicting the changing pattern of soil moisture on the hillslope; a combined index proved most appropriate, but only at times of high soil wetness. The results imply that slope area is a more important control of the distribution of soil moisture than contour curvature, at least for the site studied. (Alexander-PTT) W87-00424

REDUCTION IN SUMMER SOIL WEINESS INDUCED BY AN INCREASE IN ATMOS-PHERIC CARBON DIOXIDE,

National Oceanic and Atmospheric Administra-tion, Princeton, NJ. Geophysical Fluid Dynamics

S. Manabe, and R. T. Wetherald. Science SCIEAS, Vol. 232, No. 4750, p 626-628, May 2, 1986. 3 fig, 14 ref.

Descriptors: *Soil water, Water, *Atmospheric water, *Carbon dioxide, Model studies, Mathematical models, Seasonal variation, Climates.

The geographical distribution of the change in soil wetness in response to an increase in atmospheric carbon dioxide was investigated by using a mathematical model of climate. Responding to the increase in carbon dioxide, soil moisture in the model would be reduced in summer over extensive regions of the middle and high latitiudes, such as the North American Great Plains, western Europe, Canada, and Siberia. These results were obtained from the model with predicted cloud cover and are

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qualitatively similar to the results from several numerical experiments conducted earlier with prescribed cloud cover. (Author's abstract) W87-00497

CANOFY DYNAMICS AND CARBON GAIN IN RESPONSE TO SOIL WATER AVAILABILITY IN ENCELIA FRUTESCENS GRAY, A DROUGHT-DECIDUOUS SHRUB, Utah Univ., Salt Lake City. Dept. of Biology. For primary bibliographic entry see Field 2I. W87-00577

LATE SEASON HEAT FLUX AND WATER DISTRIBUTION IN SUMMER-FALLOWED HAPLOXEROLLS,

Agricultural Research Service, Pendleton, OR. Columbia Plateau Conservation Research Center. J. L. Pikul, R. R. Allmaras, and S. E. Waldman. Soil Science Society of America Journal SSSJD4, Vol. 49, No. 6, p 1517-1522, November-December 1985. 5 fig, 3 tab, 23 ref.

Descriptors: *Water loss, *Soil water, *Evaporation, *Oregon, Heppner, Soil mulch, Tillage, Seedzone.

Late season heat flow and water regimes in a field soil with a long history of tillage without mold-board plowing were described. Micrometeorological and soil conditions associated with water loss patterns from soil depths corresponding to the seedsone were investigated. Field studies were conducted from August 1 to November 1, 1976 and 1977 at a site 30-km north of Heppner, OR on the southern fringe of the wheat-fallow area of the Pacific Northwest. Soil water evaporation rates did not decline as potential evaporation decreased during August through November. Dry conditions characterized the 1976 study. Intermittent rain during 1977 rewet and consolidated the soil mulch. Soil water evaporation during the 1977 study did not change appreciably from early September to early October even though potential evaporation declined 40%. There were no clear relations between soil heat flux and water loss from the profile. (Peters-PTT)

TILLAGE EFFECTS ON SOIL TEMPERATURE, SOIL WATER, AND WHEAT GROWTH IN SOUTH AUSTRALIA,

AS SOULH AUSTRALIA, Agricultural Research Service, Kutztown, PA. J. K. Radke, A. R. Dexter, and O. J. Devine. Soil Science Society of America Journal SSS/ID4, Vol. 49, No. 6, p 1542-1547, November-December 1985. 4 fig, 3 tab, 22 ref.

Descriptors: *Soil water, *Soil structure, *Wheat, *South Australia, *Cultivation, Tillage, Soil temperature, Crop yield, Plant growth.

The effects of different types of tillage on soil structure, soil temperature, and soil water were determined in South Australia under uncropped and wheat-cropped conditions. Plots of an Urrbrae fine sandy loam (Rhodoxerall) were tilled with either a scarifier (tine digger) or a rotary cultivator (rotovator), or left untilled as checks. Wheat (Triticum sestivum L cv. Cabo) was planted on June 9, 1981 on half of the tilled plots resulting in 5 treatments randomized over plots in each of 3 replicates. Soil water content in the surface 10 mm was measured at 0800 and 1600 hours on work days in two replicates. Soil water profiles, plant heights, soil structure, and penetrometer resistances were determined at various times on selected plots and replicates during the growing season. June and July were unusually cool and wet and wheat growth was alow. After August 12, wheat grown on rotovated plots was significantly taller and yielded more at harvest in December than wheat grown on scarified plots. Soil water in the surface 10 mm tended to be greater for scarified treatments until late August. It was concluded that differences in wheat plant height were related to soil structure and soil water but not to soil temperature. (Peters-PTT)

RELATIONSHIP BETWEEN THE RUNOFF CURVE NUMBER AND HYDROLOGIC SOIL PROPERTIES,

PROPERTIES, Southern Illinois Univ. at Carbondale. Dept. of Plant and Soil Sciences. For primary bibliographic entry see Field 2A. W87-50631

EXPERIMENTAL AND NUMERICAL STUDY OF WATER AND SOLUTE INFILTRATION IN LAYERED POROUS MEDIA, Edigenoesische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Was-

Eidgenoessische Technische Hochschule, Zuric (Switzerland). Inst. fuer Hydromechanik und Was serwirtschaft. For primary bibliographic entry see Field 2F. W87-00632

DETERMINATION OF THE COMPONENTS OF STORMFLOW USING WATER CHEMIS-TRY AND ENVIRONMENTAL ISOTOPES, MATTOLE RIVER BASIN, CALIFORNIA, Geological Survey, Menlo Park, CA. For primary bibliographic entry see Field 2E. W87-00637

SATURATED HYDRAULIC CONDUCTIVITIES OF GRANITIC MATERIALS OF THE IDAHO BATHOLITH,

Forest Service, Ogden, UT. Intermountain Research Station. For primary bibliographic entry see Field 2E. W87-00640

RELATIONSHIP OF MYCORRHIZAL GROWTH ENHANCEMENT AND PLANT GROWTH WITH SOIL WATER AND TEXTURE.

Agricultural Research Service, Albany, CA. For primary bibliographic entry see Field 2I. W87-00669

MICROBIAL RESPONSES TO SALT-INDUCED OSMOTIC STRESS: V. EFFECTS OF SALINITY ON GROWTH AND DISPLACEMENT OF SOIL RACTERIA.

Waterloo Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 5C. W87-00723

DEVELOPMENT AND APPLICATION OF A COMBINED SOIL WATER-SLOPE STABILITY

COMBINED SOLD THE COMBINED SOL

Descriptors: *Model studies, *Slope stability, *Soil water, Infiltration, Hong Kong, Residual soils, Soil strength.

A general one-dimensional soil-water infiltration scheme is coupled to an infinite slope stability analysis model to illustrate the potential of exploring the impact of soil suction and parameter variability in stability analysis. The model shows that current procedures for estimating cohesion and the angle of internal friction may not accurately reflect the strength of residual soils examined. Four points are discussed concerning the application of the enhanced stability model incorporating pore water pressure and the effects of variability of soil properties. (1) The distribution of the minimum F (factor of safety) converges to normal and has a range small enough for the model to be useful for design purposes. (2) Added reliability of prediction of minimum F can be achieved by reducing that component of variability of soil strength properties associated with measurement of error. (3) Variability may be most significant in relatively shallow residual soils, although these may not be critical in terms of stability. (4) The enhanced model still predicts the 40 degree slope to be unstable. Therefore, it is important to establish that the procedures to model pore water pressure and variability are well founded. (Doria-PTT)

W87-00759

SOIL PROPERTIES AFFECTING RUNOFF, Western Australia Dept. of Agriculture, South Perth.

R. G. Pepper, and J. G. Morrissey.

Journal of Hydrology JHYDA7, Vol. 79, No. 3/4,
p 301-310, July 30, 1985. 5 tab, 17 ref.

Descriptors: *Soil properties, *Runoff, *Soil surfaces, Catchment areas, Dams, Soil chemistry, Clays, Soil types, Rainfall, Agricultural runoff, Surface runoff.

It is common practice in the Western Australian agricultural areas to bare, smooth, and compact soil surfaces to increase rainfall runoff into earth dams. These water catchment and storage systems are used to supply water to livestock. Three landforming treatments were compared in the pastoral area near Kalgoorlie over a period of 14 months. Treatments included: (1) a conventional road catchment; (2) flat grading followed by two passes with a smooth vibrating steel roller; and (3) flat grading followed by two passes with a multifired roller. Runoff amounts from the treatments were not significantly different, possibly because of the small plot size (10 x 4 m). Large variations between replications enabled a detailed study of those inherent soil properties that governed runoff. It was found that runoff was positively related to the clay content and exchangeable sodium percentage of the soil, and negatively related to the exchangeable calcium percentage. (Doria-PTT)

EVAPORATION RATE FROM A SALT PAN: ESTIMATES FROM CHEMICAL PROFILES IN NEAR-SURFACE GROUNDWATERS,

Australian National Univ., Canberra. Research School of Earth Sciences. For primary bibliographic entry see Field 2D. W87-00786

INFILTRATION INTO DECOMPOSED GRAN-ITE SOILS: NUMERICAL MODELLING, AP-PLICATION ON SOME LABORATORY OB-SERVATIONS,

Hong Kong Univ. Dept. of Civil Engineering. A. W. Jayawardena, and J. J. Kaluarachchi. Journal of Hydrology JHYDA7, Vol. 84, No 3/4, p 231-260, May 30, 1986. 17 fig. 4 tab, 23 ref.

Descriptors: *Finite element method, *Numerical analysis, *Unsaturated flow, *Porous media, *Granitic soil, *Infiltration, *Mathematical models, Simulated rainfall, Percolation, Permeability coefficient, Volumetric moisture content, Soil water pressure, Field test, Rainfall Intensity, Wetting front.

A finite element based numerical procedure was developed for solving the equation that describes unsaturated flow through porous media and the model was used to predict moisture movement in an artificial slope of reconstituted decomposed granite, which was subjected to controlled rainfall at five different intensities ranging from 12 to 130 mm/hr. Formulations for both ponded infiltration and rain infiltration conditions are presented. Solutions were verified by comparison with several known solutions using published soil hydraulic properties. A parameter sensitivity analysis indicated that the solutions are more sensitive to kappatheta (hydraulic conductivity - volumetric moisture content) than psi - theta (psi = soil water pressure) variations. In the field study with reconstituted decomposed granite, parameters were estimated using data collected during the desorption cycle. Satisfactory predictions of moisture content and soil suction were made for low- and highintensity rainfalls, thereby illustrating the feasibility of using the one-dimensional approach for a seemingly two-dimensional problem. Some laboratory observations of the wetting front, the wetting front advancing rate, and moisture redistribution after infiltration also are presented. (Rochester-PTT)

2H. Lakes

REVIEW OF PRIMARY PRODUCTION AND DECOMPOSITION DYNAMICS OF THE BELOWGROUND MARSH COMPONENT, Rutgers - The State Univ., Camden, NJ. Dept. of Biology.

Biology.
R. E. Good, N. F. Good, and B. R. Frasco.
IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 139-157, 1 fig. 2 tab, 74 ref.

Descriptors: *Marshes, *Subterranean aspects, *Decomposition, *Primary production, Estuaries, Estuarine environment, Cycling nutrients, Marsh substrate, Water level fluctuations, Hydrological aspects, Creeks.

Studies of belowground production and decomposition in marsh systems have lagged behind above-ground studies for technical reasons. Sampling is difficult, especially in species where much of the belowground material consists of large irregularly spaced components such as tubers and rhizomes. Despite these and other problems a growing body of literature on belowground production is emerging. Belowground standing crop and productivity are large, typically exceeding aboveground measurements for the same species. Root/shoot ratios are variable, showing the influence of the species, life history, hydrology/habitat, and climate. The most active portion of the belowground zone appears to be the upper 10 cm. The pathways and contribution of belowground material to the food chains and nutrient cycling are poorly known at present. Opportunities for transport of materials are variable; creekside habitats may contribute relatively larger amounts of nutrients to the estuarine system than those only occasionally flooded. In many marshes a considerable amount of belowground material eventually becomes incorporated into the marsh substrate, thereby maintaining the structure of the marsh and even determining future existence in areas of rising water level or land subsidence. (See also W87-0005) (Author's abstract) W87-00014 stract) W87-00014

ANALYSIS AND REVISION OF A RESERVOIR WATER QUALITY MODEL,
Army Engineer Waterways Experiment Station,
Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W87-00037

ZONATION OF PLANTS IN FRESHWATER

LAKES, Saint Andrews Univ. (Scotland). Dept. of Botany. For primary bibliographic entry see Field 2I. W87-00040

FISH IN LAKE MICHIGAN: DISTRIBUTION OF SELECTED SPECIES, Michigan State Univ., East Lansing. Dept. of Geography.

L. M. Sommers, C. Thompson, S. Tainter, L. Lin, and T. W. Colucci.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-169896, Price codes: A02 in paper copy, A01 in microfiche. Report No. MICHU-S-G-81-600, June 1981. 38 p, 47 ref. Michigan Sea Grant Advisory Program.

Descriptors: *Lake Michigan, *Fish, *Population density, *Population dynamics, Chinook salmon, Coho salmon, Lake trout, Lake whitefish, Bloater chub, Yellow perch, Rainbow smelt, Alewife, Lakes, Thermal effects, Water currents.

Billions of fish inhabit the shallows and depths of Lake Michigan, the sixth largest lake in the world. The movements of fish are anything but reliable, yet their actions are far from random. This publication explains where individual species of fish concentrate in Lake Michigan and why. It analyzes eight (Chinook salmon, Coho salmon, Lake trout, Lake whitefish, Bloater chub, Yellow perch, Rainbow smelt, and Alewife) species of fish for various

seasons of the year pointing out main, moderate and light concentrations, and it relates these patterns to the natural factors which determine locations and concentrations of the various species. The main factor is water temperature. Other physical factors involved are surface currents, upwelling, and water depths especially as they affect temperature. Food supplies, competition from other species, and some other influences are also discussed. Also described are changes in the distribution patterns through recent history of the Lake. Many changes in fish communities have been directly or indirectly the result of human actions in Lake Michigan and the surrounding Great Lakes basin. Most species currently present in the Lake are native stocks. In recent decades several important species have been introduced to the Lake, notably the salmon. Several others, sea lamprey and alewives, were inadvertently admitted to the Lake through human alterations of Great Lakes channels to the ocean. Alterations in water quality are the major human influence currently affecting Lake Michigan fish. (Lantz-PTT) W87-00078

NUMERICAL LUMPED-PARAMETER MODEL FOR SIMULATING THE ISOTOPIC EVOLUTION OF CLOSED-BASIN LAKES, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
F. M. Phillips, M. A. Person, and A. B. Muller. Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 73-86, June 15, 1986. 6 fig, 1 tab, 28 ref.

Descriptors: *Numerical analysis, *Model studies, *Simulation analysis, *Isotopic evolutions, *Lake basins, Mathematical analysis, Temperature, Humidity, Salinity, Owens Lake, California.

A wide variety of analytical solutions to differen-tial equations have been used successfully to model the isotopic evolution of lakes. However, applica-tion of this type of model is limited because many tion of this type of model is limited because many lakes exhibit varying fluxes and environmental conditions which are not amenable to the use of simple analytical solutions. The paper presents a finite-difference lumped-parameter model which is sufficiently flexible enough to accomodate fluctuating water balances as well as varying temperature, humidity, and salinity (with its effects on the chemical activity of water and the isotopic fractionation factors). The model has been applied to the observed isotopic evolution of Owens Lake in California, during a desiccation episode, leading to the conclusion that anomalously light atmospheric vapor has strongly affected the course of the lake's isotopic evolution. (Author's abstract)

OUTFLOW SKEWNESS IN NON-SEASONAL LINEAR RESERVOIRS WITH GAMMA-DISTRIBUTED MARKOVIAN INFLOWS, Lancaster Univ., Bailrigg (England). Dept. of Mathematics.

D. Warren. Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 127-137, June 15, 1986. 2 fig, 7 ref, append.

Descriptors: *Reservoirs, *Statistical models, *Skewness, *Markov Process, Reservoir inflow, Reservoir outflow, Mathematical analysis, Laplace equation, Reservoir storage.

A simple discrete-time model is considered for an unbounded (topless) spontaneous reservoir, i.e. a reservoir with infinite capacity (e.g. an entire catchment) whose outflow depends on storage. The author's have developed a technique for finding the skewness of the outflows when then inflows are modelled by a stationary, gamma-distributed Markov chain. This involves obtaining the lower moments of a weighted sum of Markovian variables, which is achieved by exploiting a result of the Laplace transform (LT) of such a sum. (Lantz-PTT)

DIRECT MEASUREMENT OF ATP AND ADENINE NUCLEOTIDE POOL TURNOVER IN MICROORGANISMS: A NEW METHOD FOR

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ENVIRONMENTAL ASSESSMENT OF ME-TABOLISM, ENERGY FLUX AND PHOSPHO-RUS DYNAMICS, Hawaii Univ, Honolulu. Dept. of Oceanography. P. Bossard, and D. M. Karl.

No. 1, p 1-13, January, 1986. 5 fig, 3 tab, 31 ref. OCE82-16673.

Descriptors: *Adenosine triphosphate, *Phosphorus, *Cycling nutrients, *Nutrients, *Microorganisms, Monitoring, Adsorption, Microbiological studies, Radioactive studies, Radioactive tracers,

A method has been devised which enables the direct measurement of ATP and adenine nucleotide pool turnover. The method is based upon the incorporation of PO4(32) into the alpha-, beta-, and gamma-P positions of ATP. PO4(32) uptake time course experiments were conducted in seawater and freshwater samples. Determinations of the ATP concentration and of the specific activities of the alpha-, beta-, and gamma-positioned P32 in ATP at sequential time points enables the calculation of: the pool size of total biologically available P in water samples; the rate of biochemical energy flux; and the mean microbial community specific growth rate. This method is relatively simple, straightforward and extremely sensitive. It has, therefore, the advantage that it can be employed in environments where dissolved P levels are too low to obtain reliable P flux estimates using existing techniques. (Author's abstract) techniques. (Author's abstract) W87-00163

UNDERWATER LIGHT-FIELD OF LAKES WITH MARKED PHYSICOCHEMICAL AND BIOTIC DIVERSITY IN THE WATER COLUMN,

Univ., Hobart (Australia). Dept. of L. C. Bowling, and P. A. Tyler. Journal of Plankton Research JPLRD9, Vol. 8, No. 1, p 69-77, January, 1986. 7 fig, 31 ref.

Descriptors: *Meromictic lakes, *Radiometry, *Turbidity, *Limnology, Error analysis, Chloro-phyli, Light penetration, Mixolimnion, Chemo-cline, Thermocline, Photosynthesis, Absorption, Color.

Various influences effect the penetration of photosynthetically available radiation (PAR) through
the water column, especially in sheltered meromictic lakes. Errors in calculation of radiant fluxes of
downdwelling underwater PAR from force-fitting
statistical values of the apparent vertical attenuation coefficient to vertical broad-band profiles
may occur from turbidity, gilvin and chlorophyll.
These problems were examined in two Tasmanian
meromictic lakes, Lake Fidler and Sulphide Pool,
where vertical zonation of gilvin and microorganisms in the mixolimnia and across the chemoclines
produces a markedly heterogeneous water column. nisms in the mixolimnia and across the chemoclines produces a markedly heterogeneous water column. Localized concentrations of gilvin produce kinked profiles of downdwelling PAR (400-700 nanometers), and microbial plates in the vicinity of the chemoclines acts as false, reflective bottoms, which abruptly extinguish residual PAR by absorption and scattering. Careful underwater quantaradiometry can ameliorate such errors and help correct calibration inconsistencies between identical instruments (Gieser, PITT). ments. (Geiger-PTT) W87-00164

VARIABLES AFFECTING TWO ELECTRON TRANSPORT SYSTEM ASSAYS, Texas Univ. at Dallas, Richardson. Inst. for Envi-ronmental Sciences. ronmental Sciences.
For primary bibliographic entry see Field 5A.
W87-00169

GROWTH OF METHANOGENIC BACTERIA IN PURE CULTURE WITH 2-PROPANOL AND OTHER ALCOHOLS AS HYDROGEN DONORS, Illinois Univ. at Urbana-Champaign. Dept. of Microbiology.

Group 2H-Lakes

For primary bibliographic entry see Field 5B. W87-00172

WETLANDS OF THE NEW JERSEY PINE WETLANDS OF THE NEW JERSEY PINE BARRENS: THE ROLE OF SPECIES COMPO-STION IN COMMUNITY FUNCTION, Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies. J. G. Ehrenfeld. American Midlands Naturalist AMNAAP, Vol. 113, No. 2, p 301-313, April 1986. 2 fig, 6 tab, 38 ref.

Descriptors: "New Jersey Pine Barrens, "Wet-lands, "Species composition, "Primary productivi-ty, "Floodwater, Swamps, Species diversity, Bio-mass, Nitrogen, Flotam, Hydrology, Cycling nu-trients, Plant populations, Pine trees.

Of the 25% of the New Jersey Pine Barrens that is wetland, about 60% consists of hardwood-dominated or pitch pine-dominated communities. Although these swamps have different dominant trees, the shrub and herb layers share many species, and the types intergrade. Twelve stands representing four variants of these swamps were sampled for species composition, biomass, net primary production (NPP) and nitrogen dynamics. Pine lowlands, which have large numbers of small trees and a dense layer of small shrubs, have a low total stand biomass (56 mt/ha), but a high NPP (8027 kg/ha/yr). Because of physical damage from moving water and flotsam, hardwood swamps affected by stream floodwaters have lower biomass (133 mt/ha) and NPP (5434 kg/ha/yr) than do swamps with either short hydroperiods or long (135 mt/ns) and NFF (3434 kg/ns/yr) than do swamps with either short hydroperiods or long hydroperiods of stationary to slowly moving floodwater (biomass 146-150 mt/hs, NPP 5857-6643 kg/ns/yr). The absolute and relative abun-dance of small-stemmed shrubs is correlated with dance of small-stemmed shrube is correlated with site hydrology; large-stemmed species are found in wet sites, whereas small-stemmed species are found in the drier sites. The shrub species differ in the relative amounts of perennial and leaf tissue. These differences, together with the differences in occurrence of large and small species, account in part for the differences in net production and nitrogen cy-cling among the wetland types. (Author's abstract) W87-00173

LITTER DECOMPOSITION PROCESSES IN A FLOODPLAIN FOREST, Emory Univ., Atlanta, GA. Dept. of Biology. For primary bibliographic entry see Field 5B.

MICROSITE ABUNDANCE AND DISTRIBU-TION OF WOODY SEEDLINGS, IN A SOUTH CAROLINA CYPRESS-TUPELO SWAMP, CAROLINA CYPRESS-TUPELO SWAMP, Savannah River Ecology Lab, Aiken, SC. L. F. Huenneke, and R. R. Sharitz. American Midland Naturalist, Vol. 115, No. 2, p 328-335, April, 1986. 1 fig. 2 tab, 25 ref. DOE Contract No. AC09-76SR00819.

Descriptors: *Swamps, *Wetlands, *Species composition, *Species diversity, *Germination, Succession, Sediment erosion, Seedings, Fluvial sediments, Microenvironment, Distribution pattern, Ecological distribution, Trees, South Carolina, Savanah River floodplain.

At least 16 types of microsites or substrates for vascular plant seedlings can be identified in bald cypress-water tupelo (Taxodium distichum-Nyssa aquatica) swamps. The relative abundances of these microsite types, and the distribution of woody seedlings on them were determined in two riverine swamp forests on the Savannah River flood-plain, South Carolina. Microsite abundances in a little disturbed forest differed significantly from those in a more open stand which had experienced much sediment deposition from upstream erosion, as well as higher water temperatures. Woody seedlings were distributed non-randomly smoag microsite types. Microsite distribution patterns differed significantly among growth forms (tree species vs. ahrubs vs. vines) and among species within growth forms. Human activities may alter substrate nature and abundance in a wetland,

thus indirectly altering the abundance and species composition of seedling recruitment. (Geiger-PTT) W87-00175

MIRES OF JAPAN IN RELATION TO MIRE ZONES, VOLCANIC ACTIVITY AND WATER CHEMISTRY,
Hokkaido Univ., Sapporo (Japan). Graduate
School of Environmental Science.
For primary bibliographic entry see Field 2K.
W87-00182

METEOROLOGICAL FACTORS AFFECTING THE BLOOM OF ANABAENOPSIS RACI-BORSKII WOLOSZ. (CYANOPHYTA: HOR-MOGONALES) IN THE SHALLOW LAKE BA-LATON, HUNGARY, Balatoni Limnologiai Kutato Intezete, Tihany

(Hungary). For primary bibliographic entry see Field 5C. W87-00184

SIZE FRACTIONATION OF ALGAL CHLORO-PHYLL, CARBON FIXATION AND PHOSPHA-TASE ACTIVITY: RELATIONSHIPS WITH SPECIES-SPECIFIC SIZE DISTRIBUTIONS AND ZOOPLANKTON COMMUNITY STRUC-TURE

TURE, Notre Dame Univ., IN. Dept. of Biology. J. J. Elser, M. M. Elser, and S. R. Carpenter. Journal of Phytoplankton Research JPLRD9, Vol. 8, No. 2, p 365-383, March, 1986. 8 fig, 3 tab, 58 ref. NSF Grant No. BSR 83 08918.

Descriptors: *Lakes, *Zooplankton, *Chlorophyll, *Carbon, *Algae, *Biomass, Grazing, Phytoplankton, Enzymes, Photosynthesis, Food chains, Indiana, Peter Lake, Paul Lake, Tuesday Lake.

Algal chlorophyll, carbon fixation and alkaline Algal chlorophyll, carbon fixation and alkaline phosphatase activity were net-fractionated using 22-micron, and 75-micron screens in three lakes with contrasting zooplankton communities. Size distributions of algal biovolume were also found between size distributions obtained through net fractionation and those determined by microscopic examination. Biovolume-specific carbon fixation and chlorophyll decreased with increasing fraction size but no differences were observed among fractions. examination. Biovolume-specific carbon fixation and chlorophyll decreased with increasing fraction size but no differences were observed among fractions for chlorophyll-specific carbon fixation. High algal standing stocks and low phosphorous deficiency in Tuesday Lake were attributed to low grazing pressure by small, inefficient zooplankton and possible limitation by nutrients other than phosphorous. Algal standing stocks were low and phosphorous deficiency was high in Peter and Paul Lakes, in which the zooplankton was dominated by larger grazers. Different algal size fractions experienced differing degrees of phophorus deficiency. These size fraction differences in P-deficiency in Peter and Paul Lakes were attributed to differences in algal species composition and to differing levels of zooplankton grazing pressure and nutrient regeneration. A unimodal relationship between relative nanoplankton biovolume and zooplankton biomass was found and reflects the positive (nutrient regeneration) and negative (grazing mortality) effects of zooplankton on the algal community. (Author's abstract)

GRAZING OF PLANKTONIC DIATOMS BY MICROFLAGELLATES, British Columbia Univ., Vancouver. Dept. of

Botany. C. A. Suttle, A. M. Chan, W. D. Taylor, and P. J.

C.A. Sutue, A. M. Chan, W. D. 1 aytor, and P. J. Harrison.

Journal of Plankton Research JPLRD9, Vol. 8, No. 2, p 393-398, March, 1986. 3 fig. 20 ref. Canada Dept. of Fisheries and Oceans, Science Subvention Grant 65-1849.

Descriptors: *Plankton, *Diatoms, *Grazing, *Algae, *Flagellates, Food chains, Limiting nutrients, Nutrients, Lakes, Ecosystems, Aquatic popu-

Laboratory experiments were conducted in May 1983 to assess the effect that different rates of

supply of a limiting nutrient have on phytoplankton physiology and community structure. After
one week of the experiment a biflagellate, heterotrophic microflagellate (HMF) tentatively identified as Paraphysomonas sp. and ranging in diameter from 6 to 14 microns was present in all cultures.
The coloriess HMF was shown to consume diatoms up to six times longer than its diameter.
Observations were also made of morphologically
similar flagellates attached to diatoms from the
Great Lakes, indicating that this phenomenon may
occur in natural waters. It is theorized that predation by microflagellates on much larger algal cella
could potentially affect the pathway of nutrient
and energy transfer in aquatic food webs. (GeigerPTT) W87-00187

WITHIN-LAKE DISPERSAL OF THE PROSO-BRANCH SNAILS, VIVIPARUS ATER AND POTAMOPYRGUS JENKINSI, Zurich Univ. (Switzerland). Zoological Museum.

G. Ribi. Oecologia OECOBX, Vol. 69, No. 1, p 60-63, April 1986. 4 tab, 19 ref.

Descriptors: *Lakes, *Snails, *Colonization, *Lake Zurich, Life tables, Dispersal, Limenology, Random distribution, Population growth, Switzer-

The recent dispersal of Viviparus Ater and Potamopyrgus Jenkinsi in Lake Zurich (Switzerland) is compared to a simple diffusion model to see if such a model is sufficient to explain the observed dispersal. If it is assumed that both species dispersed in the lake starting from one location, a model of random diffusion is insufficient to explain their present distribution. It is suggested that both species were dispersed by humans. Passive dispersal by birds, fish, or floating algae may also have occurred with P. jenkinsi. To estimate the rate of within-lake dispersal, life tables were constructed and the diffusivity estimated for both species. Per capita population growth rates were calculated to be 0.00337/day for V ater and 0.0159/day for P. jenkinsi. Diffusivity was close to 1 sq m/day in both species. (Rochester-PTT)

SELECTIVE FEEDING OF FOUR ZOOPLANK-TON SPECIES ON NATURAL LAKE PHYTO-

PLANKTON, Konstanz Univ. (Germany, F.R.). Limnological

K. Knisely, and W. Geller. Oecologia OECOBX, Vol. 69, No. 1, p 86-94, April 1986. 3 fig, 2 tab, 57 ref.

Descriptors: *Zooplankton, *Phytoplankton, *Lakes, *Grazing, Limenology, Filtering rates, *Lake Constance, Microscopy, Feeding.

*Lake Constance, Microscopy, Feeding.

Grazing experiments evaluated by microscopical counting were conducted with different size classes of Daphnia hyalina. D galeata, Eudiaptomous gracilis, and Cyclops sp., all from Lake Constance, using natural lake phytoplankton as food. Species-specific grazing selectivity coefficients were calculated for the dominant phytoplankton species from weekly experiments. Specific selectivities were largely invariant throughout the growing season. All zooplankters grazed more efficiently on phyto-flagellates such as Rhodomonas and Cryptomonas than on coccales such as Chlorella and Scenedesmus, regardless of their relative abundance in the phytoplankton assemblage. Filtering rates did not decrease in the presence of filamentous algae. Certain filamentous species were grazed efficiently, but only by D. hyalina: Anabeana planktonica, Oscillatoria amphigranulata, and Stephanodiscus binderanus. Large diatom colonies like Asterionella formosa and Fragilaria crotonensis were grazed well only by Cyclops sp. Some algal species were consistently selected against: Mougeotia thylespora and Dinobryon sp. The species-specific selectivity coefficients can be used as weighting factors to assess the 'effective food concentration' relative to Rhodomonas minuta, a reference species for optimal food. (Author's abstract)

W87-00217

INTERACTIONS AMONG FACTORS AFFECTING GROWTH, DEVELOPMENT AND SURVIVAL IN EXPERIMENTAL POPULATIONS OF BUPO TERRESTRIS (ANURA: BUPONI-DAE), Florida State Univ., Tallahassee. Dept. of Biologi-

cal Science.

J. Travis, and J.C. Trexler.
Oecologia OECOBX, Vol. 69, No. 1, p 110-116,
April 1986. 5 tab, 53 ref. NSF Grant DEB 8102782.

Descriptors: *Bufo terrestris rates, *Growth, *Larval survival, Environmental harshness, Ponds.

*Larval survival, Environmental harshness, Ponds. A series of field experiments were designed to investigate the importance of interactions between biotic and abiotic factors on the survival and development of larval cohorts of Bufo terrestris. Five 'blocks' in a large pond represented environments of varying physical harshness. In the more severe blocks, increased density inhibited growth rates, yet in the more benign blocks, increased density enhanced growth rate. Although different blocks produced very different levels of survival to metamorphosis and size at metamorphosis, there were no interactions with density. Increased density produced lengthened development times in the harsher blocks, but had no effect in the less stressful blocks. Hatchlings that were in the lowest of three initial size classes never caught up with their larger contemporaries and survived poorly. Hatchlings in the middle and largest size classes performed equivalently in all parameters of growth and development, but hatchlings from the middle size class were less likely to survive than their larger contemporaries. The effects of initial size did not interact with block. The inhibitory patterns displayed by density in conjunction with varying physical environments are similar to those found in comparable experiments with plants. (Author's abstract) W87-00218

EFFECTS OF ALUMINUM AND LOW PH ON GROWTH AND DEVELOPMENT IN RANA TEMPORARIA TADPOLES,

Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.

For primary bibliographic entry see Field 5C.

W87-00219

EFFECT OF GROWTH CONDITIONS AND SURFACE CHARACTERISTICS OF AQUATIC BACTERIA ON THEIR ATTACHMENT TO SOLID SURFACES, Warwick Univ., Coventry (England). Dept. of Environmental Sciences. S. McEldowney, and M. Fletcher.
Journal of General Microbiology, Vol. 132, No. 2, p. 513-523, February 1986. 1 fig. 4 tab, 40 ref.

Descriptors: "Aquatic bacteria, "Substrates, "Nutrition, "Bacterial adhesion, Hydrophobic polystyrene substrates, "Hydrophilic polystyrene substrates, "Cell surface, "Biofilms, Electrostatic interactions, Chloramphenicol, Periodate, Prote-

The physico-chemical basis for the effects of nutrient conditions on the attachment of four freshwater is a see, Pseudomonas fluorescens, Enterobacter cloacae, Chromobacterium sp., and Flexibacter sp., to hydrophobic (PD, polysytrene Petri dish) and relatively hydrophilic (TCD, tissue culture treated polystyrene Petri dish) surfaces was investigated. The phenotypic changes in cell surfaces for each species. Levels of bacterial adhesion differed for the two substrata, indicating different adhesion interactions with PD and TCD surfaces. Treatment of attached cells with chloramphenicol did not cause detachment of any of the bacteria from either surface, whereas periodate and protease treatment removed some attached cells, the degree of detachment depending on the species. The presence of complex organic molecules, in the liquid phase and conditioning the solid surface, influenced the extent of bacterial attachment, The physico-chemical basis for the effects of nutri-

with the effect depending on the substratum, organic concentration, and bacterial species. (Rochester-PTT) W87-00231

STRUCTURE AND FUNCTION OF A BENTHIC INVERTEBRATE STREAM COMMUNITY AS INFLUENCED BY BEAVER (CASTOR CANA-

North Carolina Univ. at Chapel Hill. Dept. of

Biology.
D. M. McDowell, and R. J. Naiman.
Oecologia OECOBX, Vol. 68, No. 4, p 481-489,
March 1986. 7 fig, 4 tab, 37 ref. NSF Grant No.

Descriptors: *Beaver, *Benthic fauna, *Reservoira *Small streams, *Predators, Collectors, Shredders, Scrapers, Chlorophyll a, Riffles, Habitat modifica-tion, Quebec, Canada, Diversity, Statistics.

tion, Quebec, Canada, Diversity, Statistics.

On Beaver Creek (north shore Gulf of St. Lawrence, Quebec, Canada) in the 1983 ice-free season, standing stocks of coarse particulate organic matter (> 1 mm) were 2-5 times greater (p<0.05) in beaver-impounded sites than in riffle sites in spring and summer. Fine (212 micrometer-1 mm) and very fine (0.5 micrometer-212 micrometer-1 mm) and very fine (0.5 micrometer-212 micrometer-1 particulate organic matter were 3-10 times greater (p<0.05) in impounded sites in all seasons. Chlorophyll a standing stocks did not differ statistically among sites. Total density and biomass of invertebrates in impoundments were 2-5 times greater (p<0.05) than riffle sites in spring and summer, but statistically similar in autumn. Generic diversity (H') was greater (p<0.05) in unaltered sites in autumn. Non-impounded sites were dominated by Simuliidae, Tanytarsini chironomids, scraping mayflies, and net-spinning caddisflies, whereas impounded sites were characterized by Tanypodinae and Chironomini chironomids, predacious odonates, Tubificidae, and filtering pelycopods. The present results suggest that paradigms currently applied to lotic ecosystems need to be reevaluated to incorporate the influence of beaver upon invertebrate communities. (Rochester-PTT)

PHYTOPLANKTON COMPETITION ALONG A GRADIENT OF DILUTION RATES, Konstanz Univ. (Germany, F.R.). Limnological

Oecologia OECOBX, Vol. 68, No. 4, p 503-506, March 1986. 2 fig, 1 tab, 16 ref.

Descriptors: *Phytoplankton, *Competition, *Phosphorus limitation, *Silica depletion, *Monod kinetics, Lake Constance, Plant physiology, Plant wth. Half-saturation c

growth, Half-saturation constant.

Natural phytoplankton on Lake Constance were used for chemostat competition experiments performed at a variety of dilution rates. In the first series of high Si:P ratios and under uniform P limitation for all species Synedra acus outcompeted all other species at all dilution rates up to 1.6/d, but at the highest dilution rate (2.0/d) Achnanthes minutissima was successful. In the second series, in the absence of any Si, a green algal replacement series was found, with Mougeotia thylespora dominant at the lowest dilution rates, Scenedesmus acutus at the intermediate ones, and Chlorella minutissima at the highest ones. The outcome of interspecific competition was not in contradiction with the Monod kinetics of P-limited growth of the five species, but no satisfactorily precise prediction of competitive performance can be derived from the Monod kinetics because of insufficient precision in the estimate of K sub s (half-saturation constant). (Author's abstract)

RECOVERY OF ADENINE-NUCLEOTIDE POOLS IN TERRESTRIAL BLUE-GREEN ALGAE AFTER PROLONGED DROUGHT PE-

RIODS, Konstanz Univ. (Germany, F.R.). Lehrstuhl fuer Physiologie und Biochimie der Pflanzen. For primary bibliographic entry see Field 2I.

W87-00236

CHANGING ROLE OF NATURAL AND AN-THROPOGENIC PROCESSES IN THE DEVEL-OPMENT OF EUTROPHICATION OF CONTI-NENTAL WATERS,

Akademiya Nauk SSSR, Leningrad. Inst. Ozerove-

For primary bibliographic entry see Field 5B. W87-00237

PROGRESS IN THE RADIOECOLOGICAL STUDY OF SEVERAL ECOSYSTEMS NEAR THE BELOYARSKII NUCLEAR POWER PLANT,

Akademiya Nauk SSSR, Sverdlovak. Inst. of Plant and Animal Ecology. For primary bibliographic entry see Field 5B. W87-00238

TEMPORAL VARIATION OF DENITRIFICA-TION ACTIVITY IN PLANT-COVERED, LIT-TORAL SEDIMENT FROM LAKE HAMPEN, DENMARK,

Aarhus Univ. (Denmark). Inst. of Ecology and

P. B. Christensen, and J. Sorensen.
Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 6, p 1174-1179, June 1986.
4 fig. 23 ref.

Descriptors: *Denitrification, *Lake sediments, *Organic substrates, *Nitrate, *Benthic algae, *Plant growth, *Daily variations, Seasons, Bacterial physiology, Lake Hampen, Denmark.

rial physiology, Lake Hampen, Denmark.

Diel and seasonal variations in denitrification were determined in a littoral lake sediment colonized by the perennial macrophyte Littorella unifiora (L.) Aschers. In winter, the activity was low (5 micromol of N/sq m per hr) and was restricted to the uppermost debris layer at a depth of 0 to 1 cm. By midsummer, the activity increased to 50 micromol of N/sq m per hr and was found throughout the root zone to a depth of 10 cm. The root zone accounted for as much as 50-70% of the annual denitrification. A significant release of organic substrates from the roots seemed to determine the high activities of root zone denitrification in the summer. The denitrification in the surface layer and in the root zone formed two distinct activity zones in the summer, when the root zone also contained nitrification activity, as indicated from the accumulations of NO3(-). Light conditions inhibited denitrification in both the surface layer and the upper part of the root zone, suggesting that a release of O2 by benthic algae and from the roots of L. unifora controlled a diel variation of denitrification in both surface layer and the upper part of the root zone was limited by NO3(-). In the growth season, there was evidence for a significant population of denitrifiers closely associated with the root surface. (Author's abstract) W87-00254 (Author's abstract) W87-00254

EFFECT OF NITRATE ON BIOGENIC SUL-FIDE PRODUCTION,

Oklahoma Univ., Norman. Dept. of Botany and Microbiology. For primary bibliographic entry see Field 5C. W87-00255

IMPACT OF STORMS ON HETEROTROPHIC ACTIVITY OF EPILIMNETIC BACTERIA IN A SOUTHWESTERN RESERVOIR,

J. G. Hubbard, and T.H. Chrzanowski.

Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 6, p 1259-1263, June 1986.
6 fig. 21 ref. Organized Research Fund of the
University of Texas at Arlington Grant 15-216.

Descriptors: *Reservoirs, *Bacteria, *Plankton, *Storms, *Metabolism, Glutamate, Acetate, Bacterial physiology, Light, Runoff, Epilimnion, Ero-

Group 2H-Lakes

sion, Sediment loading, Pollution load, Lake Arlington, Texas.

The impact of storm conditions on the heterotro-phic activity of planktonic bacteria was investigat-ed in a southwestern reservoir (Lake Arlington, Arlington, Texas). Storm events were considered as rainfall in excess of 2.5 cm in a 24-hr period before sampling. Storm conditions stimulated he-terotrophic activities and resulted in increased uptake rates and decreased turnover times of gluta-mate and acetate. Uptake rates were 45-75% faster immediately after storm conditions than they were during calm conditions. Activity levels appeared to return to prestorm levels within 48 hr. Bacterial cell numbers did not change substantially during storm events. Cell-specific activity indicated that increases in heterotrophic activity were the result of increased activity of individual cells. Light pen-etration, levels of particulate organic carbon, K. of increased activity of individual cells. Light penetration, levels of particulate organic carbon, K sub t + S sub n values, and population levels of attached bacteria suggest that immediate sediment loading of the reservoir or increased substrate levels could not account for abrupt increases in heterotrophic activities. (Author's abstract) W87-00258

ENTRAINMENT-BASED FLUX OF PHOSPHO-

RUS IN ONONDAGE LAKE, Upstate Freshwater Inst., Inc., Syracuse, NY. For primary bibliographic entry see Field 5B. W87-0020

NEW FORMULATION OF EDDY DIFFUSION

THERMOCLINE MODELS,
Salford Univ. (England). Dept. of Mathematics
and Computer Science.
B. Henderson-Sellers.
Applied Mathematical Modelling, Vol. 9, No. 6, p
441-446, December 1985. 2 fig. 2 tab, 37 ref.

Descriptors: *Mathematical models, *Thermal models, *Limnology, *Thermal stratification, *Turbulent diffusion, Epilimmion, Isotherms, Stratification, Density stratification, Hypolimnion, Thermocline, Windermere.

One-dimensional thermal stratification models (for lakes, reservoirs, oceans, fjords), based on eddy diffusion concepts to represent vertical mixing of heat, have not had extensive application due to a lack of adequate analytical representation of the neutral eddy diffusion coefficient, K sub Ho. An analytic expression, modifying the one-dimensional eddy diffusion thermocline models, was developed thereby obvaiting the need to specify the velocity profile in a lake simulation. The model chosen should be of a type compatible with the data base in use. As an example of the applicability of the model, simulations of Windermere (UK) were undertaken and these results, together with comparisons with previous empirical work, appear to substantiate this approach. (Khumbatta-PTT)

INTERFACIAL MIXING IN STRATIFIED FLOWS, National Technical Univ., Athens (Greece). Dept.

of Civil Engineering. G. C. Christodoulou.

Journal of Hydraulic Research, Vol. 24, No. 2, p 77-92, 1986, 5 fig, 1 tab, 31 ref.

Descriptors: *Flow, *Lakes, *Reservoirs, *Strati-fied flow, *Mixing, Destratification, Interfacial mixing, Turbidity flow, Turbidity, Density stratifi-

The phenomenon of turbulent mixing at a density interface was studied. Based on a unified view of the mixing processes, quantitative laws were sought, which would be generally valid in flows with mean motion in at least one of the layers. Rexamination of available experimental data from four types of stratified flow, supplemented by theoretical considerations, led to the identification of four such governing laws, all of a power form, applicable in different ranges of the overall Richardson number. Two of these laws refer to supercritical conditions and are considered as fundamen-

tal, being related to qualitatively different mechanisms of interfacial mixing. An intermediate law applies around the critical value of unity, while an name of interfacial mixing. An intermediate law applies around the critical value of unity, while an asymptotic law corresponds to the limit of homogeneous flows as Ri sub 0 tends to zero. All the above laws are given by simple expressions in terms of the mean flow characteristics, allowing their straight-forward application for the quantifications of interfacial mixing in a variety of flows. (Author's abstract) W87-00324

BENTHIC FAUNA OF 41 ACID SENSITIVE HEADWATER LAKES IN NORTH CENTRAL ONTARIO,

Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch. For primary bibliographic entry see Field 5C. W87-00332

RECOVERY OF BENTHIC INVERTEBRATE COMMUNITIES IN SILVER BOW CREEK, MONTANA, FOLLOWING IMPROVED METAL MINE WASTEWATER TREATMENT, Chadwick and Associates, Littleton, CO. For primary bibliographic entry see Field 5D. W87-00339

HYDROGEOLOGIC COMPARISON OF AN ACIDIC-LAKE BASIN WITH A NEUTRAL-LAKE BASIN IN THE WEST-CENTRAL ADI-RONDACK MOUNTAINS, NEW YORK, Geological Survey, Atlanta, GA. Water Resources Discourage of the Company of the Company

For primary bibliographic entry see Field 5B. W87-00343

OXYGEN RESOURCES OF THE HYPOLIM-NION OF IONICALLY ENRICHED ONONDA-GA LAKE, NY, U.S.A., Upstate Freshwater Inst., Inc., Syracuse, NY. For primary bibliographic entry see Field 5B. W87-00351

INFLUENCE OF MACROPHYTE DECOMPO-SITION ON GROWTH RATE AND COMMUNI-TY STRUCTURE OF OKEFENOKEE SWAMP

BATERIOPLANKTON,
Georgia Univ., Athens. Inst. of Ecology.
R. E. Murray, and R. E. Hodson.
Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 2, p 293-301, February
1986. 5 fig. 3 tab, 27 ref. NSF Grants BSR
8215587, BSR 8114823, OCE 8416384.

Descriptors: *Biodegradation, *Vegetation, *Macrophytes, Aquatic plants, Swamps, Plant growth, *Microbial degradation, Okefenokee Swamp,

Dissolved substances released during decomposi-tion of the white water lily (Nymphaea odorata) can alter the growth rate of Okefenokee Swamp can alter the growth rate of Okefenokee Swamp bacterioplankton. In microcosm experiments disolved compounds released from senescent Nymphaea leaves caused a transient reduction in the abundance and activity of water column bacterioplankton, follwed by a period of intense bacterial growth. Rates of (3H) thymidine incorporation and turnover of dissolved D-glucose were depressed by over 85%, 3 h after the addition of Nymphaea leachates to microcosms containing Okefenokee Swamp water. Bacterial activity subsequently recovered; after 20 h (3H)thymidine incorporation in leachate-treated microcosms. Was 10-fold greater than that in control microcosms. The recovery of activity was due to a shift in the composition of the than that in control microcosms. The recovery of activity was due to a shift in the composition of the bacterial population toward resistance to the inhibitory compounds present in Nymphaea leachates. Inhibitory compounds released during the decomposition of aquatic macrophytes thus act as selective agents which alter the community structure of the bacterial population with respect to leachate resistance. Soluble compounds derived from macrophyte decomposition influence the rate of bacterial secondary production and also influence the terial secondary production and also influence the availability of microbial biomass to microcon-sumers. (Author's abstract)

W87-00357

PHOTOTROPHIC SULFUR BACTERIA IN TWO SPANISH LAKES: VERTICAL DISTRIBU-TION AND LIMITING FACTORS,

Barcelona Univ. (Spain). Dept. of Microbiology. R. Guerrero, E. Montesinos, C. Pedros-Alio, I. Esteve, and J. Mas.

Limnology and Oceanography LIOCAH, Vol. 30, No. 5, p 919-931, September 1985. 6 fig, 2 tab, 39 ref. Comision Assora de Investigacion Cientifica y Tecnica, Spain Grant 0875/81.

Descriptors: *Bacteria, *Sulfur, *Limnology, *Lakes, Phototrophic bacteria, Vertical distribution, Anaerobic zones, Spain, Lake Ciso, Lake Vilar, Stratified lakes.

Vilar, Stratified lakes.

The physiology of purple sulfur bacteria in relation to their distribution in the water column and factors limiting their activity were studied in anaerobic zones of Lakes Ciso and Vilar (Banyoles karstic area, NE Spain) during summer 1982. In Lake Vilar, Chromatium spp. was dominant (up to 92% of the microbial biovolume). In Lake Ciso, the predominant microorganisms were Chromatium spp. (up to 71%) and another purple sulfur bacterium forming aggregates (20%). The bacterial layer could be divided according to the physiological state of the cells into a top part of maximal specific activity, a peak of maximal abundance and a bottom part of inactive cells. The bacteria in the peak were predominantly limited by light; sulfide, phosphate, and acetate were not limiting in the middle of the day. The light limitation started at the depth having the maximal concentration of cells; the top of the layer appeared to be sulfide limited. Specific contents of photopigments, elemental sulfur, and reserve polymers decreased from the top to the bottom of the bacterial layer. These phenomena point to the crucial role of light in the development of layers of phototrophic bacteria in stratified lakes. (Author's abstract)

PARTICULATE AND OPTICAL PROPERTIES DURING CACO3 PRECIPITATION IN OTISCO

Rochester Univ., NY. Dept. of Biology.
A. D. Weidemann, T. T. Bannister, S. W. Effler, and D. L. Johnson.

Limnelogy and Oceanography LIOCAH, Vol. 30, No. 5, p 1078-1083, September 1985. 4 fig, 2 tab, 22

Descriptors: *Lakes, *Limnology, *Calcium car-bonate, *Particulate matter, Optical properties, Deposition, Otisco Lake, New York, Turbidity.

Deposition, Otisco Lake, New York, Turbidity. In late June 1983, Secchi depth d was 3.5 m and the vertical attenuation coefficient K was <or = 0.5/m in Otisco Lake, NY. By 2 August, near the peak of a 'whiting', the values were 1.4 m and 0.64/m, and calcium-containing, acid-labile particles >4 micron comprised nearly 65% of total analyzed inorganic particles. From measured values of K and of the reflectance ratio R, the volume-scattering coefficient b was calculated to be 2.88/m and the volume absorption coefficient a, 0.31/m. Turbidity measurement confirmed the value of b and indicated nearly 60% of the value was due to CaCO3. Of the value of a, water, Gelbstoff, and chlorophyll-bearing particles contributed 54, 25, and 21%, repectively. The observed changes in d and K, from June to August, are theoretically consistent with an approximate doubling of b (due to CaCO3), with little or no change of a. (Author's abstract)

EVALUATION OF WET CHEMICAL METH-ODS FOR QUANTIFYING SULFUR FRAC-TIONS IN FRESHWATER WETLAND PEAT, For primary bibliographic entry see Field 5A. W87-00374

INSTRUMENT FOR MEASURING SMALL BOTTOM CURRENTS IN LAKES.

Lakes-Group 2H

For primary bibliographic entry see Field 7B. W87-00375

CONCEPTUAL FRAMEWORK FOR PREDICTING THE OCCURRENCE OF SEDIMENT FO-CUSING AND SEDIMENT REDISTRIBUTION IN SMALL LAKES, Freshwater Biological Association, Ambleside (England).

For primary bibliographic entry see Field 2J. W87-00376

MAGNETIC STUDIES OF EROSION IN A SCOTTISH LAKE CATCHMENT. 1. CORE CHRONOLOGY AND CORRELATION, Liverpool Univ. (England). Dept. of Applied Mathematics and Theoretical Physics. For primary bibliographic entry see Field 2J. W87-00377

210-PB DATING AND THE RECENT GEOLOGIC HISTORY OF CRYSTAL BAY, LAKE MIN-NETONKA, MINNESOTA, Minnesota Univ., Minneapolis. Limnological Research Center. S. L. Murchie.

Limnology and Oceanograph LIOCAH, Vol. 30, No. 6, p 1154-1170, November 1985. 14 fig, 3 tab,

Descriptors: *Lakes, *Radioactive dating, *Geology, *Dating, *Lead radioisotopes, Deposition, Sediments, Sediment focusing, Resuspension, Turbidity, Crystal Bay, Lake Minnetonka, Minnesota.

210-Pb dating of five cores from Crystal Bay, Lake Minnetonka, Minnesota, was used to examine the geologic history of the basin during the last century. A lakewide 210-Pb budget and the basinwide average cumulative activities of 210-Pb within time-stratigraphic units were estimated from multiple cores. Ages of time-stratigraphic markers and sediment accumulation rates of time stratigraphic units were calculated from a constant-flux 210-Pb-dating model. The basinwide bulk-sediment accumulation rate increased from 0.03 g/sq cm/yr before settlement to 0.07 g/sq cm/yr for the period from 1962 to 1983. Since settlement of the surrounding area, profundal sediment became highly calcareous and accumulation of littoral marb legan. Intensity of focusing of sediment to the center of Intensity of focusing of sediment to the center of Crystal Bay decreased as basinwide sediment accu-Crystal Bay decreased as basinwide sediment accumulation rates increased. High organic sediment was also found to be more intensely focused than heavier siliceous or calcareous sediment. Accumulation of sediment spread to regions shallower than 5 m as the rate of sedimentation exceeded the rate of sediment resuspension at that depth, about 4 mm/yr. (Author's abstract) W87-00378

SULFUR CONSTITUENTS AND CYCLING IN WATERS, SESTON, AND SEDIMENTS OF AN OLIGOTROPHIC LAKE, State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.

M. B. David, and M. J. Mitchell.
Limnology and Oceanography LIOCAH, Vol. 30, No. 6, p 1196-1207, November 1985. 6 fig. 8 tab, 40 ref.

Descriptors: *Lakes, *Sulfur, *Seston, *Sediments, Oligotrophic lakes, Mineralization, Adirondacks, New York, South Lake.

Organic and inorganic sulfur constituents in streams, the water column, seston, and sediments of an oligotrophic Adirondack lake were measured for 2 years (1981-1983). Soluble organic S constituents (C-bonded S and ester sulfate) were 1-18% of total S in streams, the water column, and lake outlet. Seston S (0.3-1.2% dry mass) in South Lake consisted of ester sulfate (44-59%), C-bonded S (32-43%), sulfate (10-16%), and nonsulfate inorganic S(-2%). Rates of S deposition measured in sediment traps were highest after spring turnover. The organic matter content (52-81% dry mass) of traps at 5, 8, and 15.5 m showed no significant differences. Net mineralization of seston inputs was

26% based on mass balance calculations, with 43% of the ester sulfate input mineralized. Because most of the S input to the sediments was not mineralized, organic S accumulated and constituted the major (74% of total S) S component of the sediment. (Author's abstract) W87-00379

CARBOHYDRATE FLUCTUATIONS, GAS VA-CUOLATION, AND VERTICAL MIGRATION OF SCUM-PORMING CYANOBACTERIA IN FISHPONDS, Hebrew Univ. of Jerusalem (Israel). Div. of Micro-bial and Molecular Ecology. J. van Rijn, and M. Shilo. Limnology and Oceanography LIOCAH, Vol. 30, No. 6, p 1219-1228, November 1985. 5 fig. 2 tab, 28 ref.

Descriptors: *Fish ponds, *Cyanobacteria, *Carbo-hydrates, *Bacteria, *Scum, Slime, Pollution, Or-ganic compounds, Ponds, Gas vacuolation, Light, Nitrogen, Vertical migration, Shallow water.

Natural populations of the scum-forming cyano-bacteria Oscillatoria, Spirulina, and Microcystis showed a diel vertical migration pattern in fish-ponds. This migration was governed by two fac-tors, light and nitrogen. Light penetrates only into the upper layers of these shallow waterbodies, while combined nitrogen is detectable only in the pond sediment. Migration between these two layers was corrolated with cellular carbohydrate accumulation at the top layer and its degradation layers was corrolated with cellular carbohydrate accumulation at the top layer and its degradation at the bottom. Gas-vacuole collapse was not mediated by turgor pressure and gas vesicles re-formed at an extermely slow rate. Thus it seems likely that a change in ballast due to carbohydrate loading at the lighted surface and unloading at the dark, nitrogen-rich bottom actively influences vertical migration. (Author's abstract)
W87-00380

ASSOCIATIONS OF ZOOPLANKTON IN SIX CRATER LAKES IN ARIZONA, MEXICO AND

CRATER LARES IN ARIZATION, MAINTAIN NEW MEXICO, Queen Mary Coll., London (England). School of Biological Sciences. J. Green. Zoological Society of London (A), Vol. 208, p 135-139, 1986. 11 fig, 16 tab, 22 ref.

Descriptors: "Zooplankton, "Limnology, "Arizona, "Mexico, "New Mexico, Lakes, Crater lakes, Salinity, Plankton, Chemical properties, Vegetation, Protozoa, Aquatic animals.

Saimty, Falanton, Chemical properties, Vegetation, Protozoa, Aquatic animals.

Zooplankton associations in six crater lakes have
been compared by means of indices of similarity
and diversity, and by k-dominance curves. The
lakes covered a wide range of salinities and vegetational characteristics. The total number of species
identified were: Protozoa, 34; Rotifera, 48; Gastrotricha, 7; Crustacea, 24; and Chaoborus larvae, 2;
giving an overall total of 115. The numbers of
zooplankton species in each lake varied from 68, in
a richly vegetated fresh crater lake in Arizona, to
one in a highly saline lake in New Mexico. Testate
rhizopods and gastrotrichs were not found in the
more saline lakes. A comparison of the rotifer
associations with those of crater lakes in other
parts of the world shows that there is a general
tendency for a reduction in the total number of
species when the conductivity rises above 400
microS/cm 20 C, and when the conductivity
reaches 10,000 microS/cm 20 C the number of
rotifer species is usually reduced to two. The two
species that were found at high salinities show that
there is some variation in different parts of the
world, but generally include species of Brachionus
and Hexarthra. There is a general tendency for the
number of rotifer species in a carter lake to increase with increasing vegetation, at least up to the
stage where there is a dense, zoned vegetation, and
before a complete mosaic of vegetation covers the
lake. (Author's abstract)
W87-00382

PHENOTYPIC VARIATION IN METAMOR-PHOSIS AND PAEDOMORPHOSIS IN THE SALAMANDER AMBYSTOMA TALPOIDEUM,

Savannah River Ecology Lab., Aiken, SC. R. D. Semlitsch, and J. W. Gibbons. Ecology ECOLAR, Vol. 66, No. 4, p 1123-1130, August 1983. 3 fig. 4 tab, 40 ref. DOE Contract DE-ACO9-76SR00819.

Descriptors: *Phenology, *Salamanders, *Water level, Water temperature, Environmental effects, Ponds, Life history studies, Survival.

Phenotypic variation in metamorphosis and paedomorphosis in the salamander Ambystoma talpoideum was studied to determine its environmental or genetic basis. Environmental treatments includication of the salamander and state and arrange of constant water level and gradual drying out to simulate permanent and temporary breeding ponds. The frequency of metamorphosis was higher in the drying treatment and differed between populations while the frequency of paedomorphosis was different between populations but not between water level treatments. Population differences in the frequency of metamorphosis and paedomorphosis could represent genetic differences resulting from selective regimes that individuals encounter in breeding ponds varying in drying frequency, but phenotypic plasticity and maternal effects cannot be dismissed without further experimentation. (Michael-PTT) el-PTT) W87-00385

LIMNOLOGICAL STUDIES OF WATERPOWL HABITAT IN SOUTH-WESTERN NEW SOUTH WALES, IL AQUATIC MACROPHYTE PRO-DUCTIVITY,

Commonwealth Scientific and Industrial Research Organization, Lyncham (Australia). Div. of Wild-life and Rangelands Research.

itle and Rangelands Research.
S. V. Briggs, and M. T. Maher.
Australian Journal of Marine and Freshwater Research AJMFA4, Vol. 36, No. 5, p 707-715, November 1985. 2 fig. 3 tab, 26 ref.

Descriptors: *Lakes, *Waterfowl, *Macrophytes, New South Wales, Aquatic productivity, Water birds, Biomass, Wetlands, Detritus, Flooding.

Aquatic macrophyte productivity and soil organic matter were measured in two impermanent wetlands in south-western New South Wales. Macrophyte biomasses were similar to or higher than those in submerged communities elsewhere. Macrophyte productivities in both wetlands were greatest in the year following reflooding. But even in that year macrophyte productivity in Lake Merrinajeel was considerably less than soil organic reserves before reflooding. It is suggested that these soil organic reserves directly contribute to the relationship between wetland flooding and waterfowl breeding, while macrophytes contribute indirectly by providing detritus for invertebrates. It is recommended that wetlands managed for waterfowl breeing should periodically dry out and reflood. (Author's abstract)

MODIFIED TECHNIQUE FOR RADAR TRACKING OF FLOAT-DROGUES IN LAKE WATER CIRCULATION INVESTIGATIONS, Dundee Univ. (Scotland), Dept. of Geology. R. W. Duck, J. McManus, and J. A. Charlton. Hydrological Sciences Journal HSJODN, Vol. 30, No. 4, p 513-521, December 1985. 4 fig, 16 ref.

Descriptors: *Lakes, *Water currents, *Water circulation, *Floats, *Radar, *Tracking techniques, *Wind-driven currents, Lake sediments, Measuring instruments, Scotland, Flow velocity, Current

A modified technique for radar tracking of float drogues used to measure slow-moving water currents in lakes is described. Capabilities of this technique include tracking of up to ten units, direct plotting of float position on acetate overlays placed above the radar display for immediate visual assessment of water movements and correction for wind drift to yield true flow velocities. The method provides a reproducible and reliable Lagrangian technique for monitoring surface and subsurface current patterns. Examples of the applica-

Group 2H-Lakes

tion of this technique in Scotland's Loch Earn are presented. (Michael-PTT) W87-00405

CHLOBOPHYLL-TOTAL PHOSPHORUS RE-LATIONSHIPS IN LAKE BURRAGORANG, NEW SOUTH WALES, AND SOME OTHER SOUTHERN HEMISPHERE LAKES, Tasmania Univ., Hobart (Australia). Dept. of

Botany.

J. M. Ferris, and P. A. Tyler.

Australian Journal of Marine and Freshwater Research AJMFA4, Vol. 36, No. 2, p 157-168, March/April 1985. 3 fig. 4 tab, 40 ref.

Descriptors: *Chlorophyll, *Phosphorus, *Lakes, Australia, Lake Burragorang, Limnology, Chemi-cal properties, Statistical analysis, Chemical analy-sis, Water pollution, Water quality.

sis, Water pollution, Water quality.

Linear regression of chlorophyll concentration on total phosphorus concentration, for phosphorus limited Lake Burragorang, N.S.W., yielded regression coefficients within the range reported for individual lakes in the Northern Hemisphere. Some variation in slope of published regressions is attributable to the choice of different regression subvariables (e.g. annual mean or annual maximum). The extent of this variation is quantified. Data from Lake Burragorang and other sites indicate that chlorophyll-phosporus relationships in the Southern Hemisphere are concordant with those in the north if turbid waters are excluded from consideration. This is obviously significant in Australia, with so many turbid waters. The notion of 'growing season' as applied to Northern sphere studies, is inappropriate for the warm temperate conditions of Lake Burragorang, and it was necessary instead to use the annual maximum chlorophyll concentration is of particular significance to water quality management. Despite highly significant regressions, 95% confidence intervals and 95% prediction limits are wide, so that prediction of chlorophyll concentration from single values of total phosphorus, using double-Ln regressions, gives a wide arithmetic range, Use of annual mean total phosphorus concentration as the predictor variable limits the forecasting ability of the Lake Burragorang regressions but facilitates future coupling with a phosphorus loading model. This would assist in the assessment of projected management plans and also in the formulation of protective criteria. (Author's abstract)

EFFECTS OF CARP, CYPRINUS CARPIO I., ON COMMUNITIES OF AQUATIC VEGETA-TION AND TURBIDITY OF WATERBODIES IN THE LOWER GOULBURN RIVER BASIN, Arthur Rylah Inst. for Environmental Research.

Arthur Ryian Inst. 107 Environmental Research, Heidelberg (Australia). A. R. Fletcher, A. K. Morison, and D. J. Hume. Australian Journal of Marine and Freshwater Re-search AJMFA4, Vol. 36, No. 3, p 311-327, Sep-tember 1985. 7 fig., 5 tab, 39 ref.

Descriptors: *Aquatic plants, *Water pollution effects, *Carp, Fish, *Turbidity, Goulburn River Valley, Broken River, Turbulent flow, Aquatic life, Australia, Water level fluctuations.

Densities of carp, ranges of turbidity, and details of communities of aquatic vegetation from 1979 to 1982 are given for several waterbodies in the Goulburn River valley including the Broken River, near Shepparton, Victoria. The turbidity values at all sites were high, typical of Australian inland waterbodies. There was no association between high carp densities and high turbidity, and populations of carp did not appear to increase turbidity. Observed turbidity increases at each site appeared to be related to hydrological changes. Fluctuation of water levels was also an important factor determining the extent of aquatic vegetation communities. Circumstantial evidence is presented that shallow-rooted and soft-leaved aquatic vegetation such as Potamogeton spp. have been reduced by carp. (Master-PTT)

COUPLED TRANSFORMATION OF INOR-GANIC STABLE CARBON-13 AND NITRO-GEN-15 ISOTOPES INTO HIGHER TROPHIC LEVELS IN A EUTROPHIC SHALLOW LAKE, National Inst. for Environmental Studies, Yatabe

National Inst. 101 (Japan).

Japan).

A. Otsuki, M. Aizaki, T. Iwakuma, N. Takamura, and T. Hanazato.

Limnology and Oceanogoraphy LIOCAH, Vol. 30, No. 4, p 820-825, July 1985. 8 fig. 23 ref.

Descriptors: *Carbon radioisotopes, *Nitrogen ra-dioisotopes, *Trophic level, *Eutrophic lakes, Lakes, Phytoplankton, Zooplankton, Plankton, Japan, Lake Kasumigaura, Coupled transforma-tion, Bottom sediments, Sediments, Lake sedi-

Enclosure and bag experiments were done in the eutrophic, shallow Lake Kasumigaura, Japan with the simultaneous use of inorganic carbon-13 and nitrogen-15 isotopes. Coupled transformation of inorganic carbon and nitrogen can occur into herbivorous zooplankton through phytoplankton. Direct evidence was provided in that there is an apparent coupling between photosynthesis and inorganic nitrogen uptake by phytoplankton during natural daytime conditions and that the coupling occurs at a constant ratio. (Author's abstract) W87-0471.

EFFECT OF REDOX CHANGES ON THE MAGNETIC SUSCEPTIBILITY OF SEDIMENTS FROM A SEASONALLY ANOXIC LAKE, Freshwater Biological Association, Ambleside (England).

J. Hilton, and J. P. Lishman.
Limnology and Oceanography LIOCAH, Vol. 30, No. 4, p 907-909, July 1985, 2 fig, 14 ref.

Descriptors: *Magnetic studies, *Oxidation-reduction potential, *Oxidation, *Lake sediments, Estwaite water, English lake district, Hypolimnion, Iron compounds, Magnetic susceptibility.

Shallow freshwater sediment cores from Estwaite Water, U.K., were allowed to oxidize while whole-core magnetic susceptibility (MS) was recorded. The variation of MS with time was plotted. The change of MS with oxidation states explained the change of MS with oxidation states explained the lack of agreement between whole-core and specific MS profiles. The presence of oxic waters above the sediments precluded the transport of oxidizable magnetic minerals to the sediments in their measured form. Thus, the magnetic component, changed by oxidation, must be formed in the sediments. This diagenetically formed mineral is probably a crystalline iron sulfide. (Jessick-PTT) W87-00479

NATURAL SOURCES OF ACID NEUTRALIZ-ING CAPACITY IN LOW ALKALINITY LAKES OF THE PRECAMBRIAN SHIELD, Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, M. A. Turner, M. P. Stainton, and G. A. Linsey.
Science SCIEAS, Vol. 232, No. 4752, p 844-847,
May 16, 1986.2 fig, 3 tab, 22 ref.

Descriptors: *Lakes, *Acid rain, *Chemical analysis, *Alkalinity, Watersheds, Ontario, Precambrian shields, Chemical properties, Biological reduction, Acidification.

A detailed alkalinity budget was constructed for Lake 239 in the Experimental Lakes Area of north-western Ontario and for three small watersheds in its terrestrial basin. Alkalinity generation in the lake averaged 118 milliequivalents/aq m/yr, 4.5 times as high as the areal rate in the terrestrial basin. Although acid deposition in the area is low, only one of the three terrestrial watersheds was a significant source of alkalinity. A second terrestrial watershed was a sink for, rather than a source of, alkalinity. An analysis of ion budgets for the lake revealed that more than half of the in situ alkalinity production was by biological rather than geochemical processes. The major processes that generated alkalinity were: biochemical reduction of

SO4(-2)(53%), exchange of H(+) for Ca(2+) in sediments (39%), and biological reduction of NO3(2-) (26%). Comparison with experimentally acidified Lake 223 revealed that alkalinity production by sulfate reduction increased in response to increased inputs of sulfuric acid. (Author's abstract) W87-00499

DISSOLVED OXYGEN MODEL FOR A DY-NAMIC RESERVOIR, Youngstown State Univ., OH. Dept. of Civil Engimary bibliographic entry see Field 5C.

IMPACT OF LAKE ACIDIFICATION ON STRATIFICATION. Upstate Freshwater Inst., Inc., Syracuse, NY. For primary bibliographic entry see Field 5C. W87-00525

FISH-FLAMINGO-PLANKTON TIONS IN THE PERUVIAN ANDES. INTERAC. THONS IN THE PERCUYIAN ANDES, San Diego State Univ., CA. Dept. of Biology. S. H. Hurlbert, W. Loayza, and T. Moreno. Limnology and Oceanography LiOCAH, Vol. 31, No. 3, p 457-468, May 1986. 3 fig. 3 tab, 53 ref. NSF Grant DEB 76-02888.

Descriptors: *Zooplankton, *Flamingoes, *Fish, *Peru, *Andes, *Copepods, *Cladocera, *Human influence, Elevation, Lakes, South America, Pre-

dation.

The zooplankton and flamingo populations of 20 high-elevation (3,700-4,700 m) lakes in the Andes of southern Peru were assessed on one to three occasions each. Some of the lakes had cyprinodont fish (Orestia spp). Lakes with fish usually had a sparse zooplankton dominated by cyclopoid copepods and chydroid cladocerans; the others tended to have an abundant zooplankton dominated by calanoid copepods and daphnids or by Artemia. Chilean flaminogos (Phoenicopterus chilensis) usually are absent or scarce on lakes with fish and present in large numbers where fish are absent. The authors suggest that the distribution of this flamingo in the Central Andes, and in South America generally, is determined primarily by the distribution of fish, with which it competes for invertebrate prey. The observed patterns of distributions are complicated by the impact on Orestias populations of man, of fish-eating birds, and of introduced, non-native fish (Salmo gairdneri, Basilichthys bonariensis). (Author's abstract)

PHYTOPLANKTON CONTROL BY GRAZING ZOOPLANKTON: A STUDY ON THE SPRING CLEAR-WATER PHASE, Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.). Dept. of Ecophysiology. W. Lampert, W. Fleckner, H. Rai, and B. E. Taylor.

Taylor.

Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 4/8-490, May 1986. 11 fig, 52 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Spring, *Clear-water phase, *Mesotrophic lakes, *Eutrophic lakes, *Transparency, Bag experi-ments, Algae, Germany, Selectivity, Herbivores.

The hypothesis that grazing herbivorous zooplankton cause a clear-water period, which is regularly
observed in many meso- and eutrophic lakes in
spring was tested. Such a clear-water period occurred in mid-May 1983 in the moderately eutrophic Schoehsee (Holstein, Germany) and involved
a rapid increase in Secchi transparency and a drop
in chlorophyll and particulate organic carbon in
size fractions <35 micron. Maxima of zooplankton
biomass and community grazing rates (170% of
volume cleared per day) coincided with the greatest transparency. The algal decline was not related
to nutrient depletion or climatic events. Before the
clear-water phase small phytoplankton contributed
up to 88% of the primary production, whereas the

Lakes-Group 2H

contribution of larger particles was greater after the zooplankton maximum. In a series of time-overlapping bag experiments, the concentrations of <35-micron particles were always higher in bags lacking zooplankton than in the controls. A mass development of small algae occurred in the zoo-plankton-free bags initiated during the clear-water phase, whereas the presence of zooplankton stimu-lated the growth of >35-micron algae. (Author's

ALGAL GROWTH RESPONSE TO PARTICLE-BOUND ORTHOPHOSPHATE AND ZINC, Geological Survey, Menlo Park, CA. Water Re-For primary bibliographic entry see Field 5C. W87-00561

ABSORPTION AND SCATTERING COEFFI-CIENTS IN IRONDEQUOIT BAY, Rochester Univ., NY. Dept. of Biology. A. D. Weidemann, and T. T. Bannister. Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 567-583, May 1986. 9 fig, 2 tab, 40 ref.

Descriptors: *Light absorption coefficient, *Light scattering coefficient, *Light attenuation coefficient, *Irondequoit Bay, *Kirk method, New York, Turbidity, Chlorophyll, Irradiance.

York, Turbidity, Chlorophyll, Irradiance.

Profiles of scalar, downwelling, upwelling, and spectral irradiance were measured in Irondequoit Bay, New York, on 37 dates in 1982-83. Values of the attenuation coefficient K were 0.8-1.2/m, and the reflectance R was 0.03-0.06. By Kirk's method, the absorption and scattering coefficient a and bwere found to be 0.44-0.83 and 1.8-5.0/m. Independent estimates of a, as the sum of absorption components, were in reasonable agreement with values obtained by Kirk's method. Turbidity, chlorophyll (Chl), and absorption spectra of dissolved yellow substances and of particles also were measured. For particles, the average value of the Chl-specific scattering coefficient k sub a was approximately 0.008-0.010 sq m/mg Chl. Values of the Chl-specific scattering coefficient k sub b usually were approximately 0.05-0.10 sq m/mg Chl; values were higher (about 0.12) when gas-vacuolate cyanobacteria were present. (Author's abstract)

DILUTION OF 210PB BY ORGANIC SEDI-MENTATION IN LAKES OF DIFFERENT TROPHIC STATES, AND APPLICATION TO STUDIES OF SEDIMENT-WATER INTERAC-

Florida State Museum, Gainesville.
M. W. Binford, and M. Brenner.
Limnology and Oceanography LIOCAH, Vol. 31,
No. 3, p 584-593, May 1986. 5 fig. 1 tab, 52 ref.
NSF Grants DAR 79-24812, EAR 82-14308, and DEB 82-11380

Descriptors: *Isotope studies, *Sedimentation, *Lake Sediments, *Trophic level, *Lead-210, *Radioactive dating, Mathematical studies, Carbon, Nitrogen, Phosphorus, Pigments, Multiple regression models, Florida, Paleolimnology.

Examination of 210Pb-dated cores from 12 Florida lakes of widely differing trophic state (expressed as Carlson's trophic state index: TSI) showed that net accumulation rate of organic matter was related to primary productivity in the water column. In 26 other lakes the activity of unsupported 210Pb/g organic matter in surficial sediments was inversely related to trophic state, therefore, to organic accumulation rate. From this observation, a new model was developed that uses fallout 210Pb as a dilution tracer to calculate net sedimentary accumulation rates of any material in surface mud. A strong relationship is demonstrated between net loss rates of biologically important materials (C, N, P and pigments) and their respective water concentrations (expressed as TSI). Multiple regression models incorporating net sediment accumulation rates of all four variables explain up to 70% of the lake-to-lake variation in TSI. The 210Pb-dilution method has applications for studies of material Examination of 210Pb-dated cores from 12 Florida

aleolimnology, and sediment accumula sees. (Author's abstract) cycling, paleoli tion process W87-00563

CARBON CYCLE FOR LAKE WASHINGTON -A STABLE ISOTOPE STUDY, Washington Univ., Seattle. Dept. of Geological

Sciences. P. D. Quay, S. R. Emerson, B. M. Quay, and A. H.

Devol. Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 596-611, May 1986. 8 fig, 9 tab, 57 ref. NSF EAR 82-06786.

Descriptors: *Limnology, *Carbon cycle, *Isotope studies, *Lake Washington, *Dissolved inorganic carbon, *Gas exchange, *Carbon dioxide, *Sedimentation rates, *Particulate organic carbon, Epilimnion, Carbon-13-carbon-12 ratio, Metalimnion, Hypolimnion, Lake sediments, Mineralization.

Hypolimnion, Lake sediments, Mineralization.

The carbon cycle in Lake Washington for the year 1980 was studied using monthly measurements of dissolved inorganic carbon (DIC) and its 13C:12C isotopic composition. Between 24 June and 13 August, the calculated CO2 gas invasion rate of 800000 moles C per day nearly equaled the river DIC inflow rate. The calculated epilimnetic net organic carbon production rate was 680000 moles C per day, about 20-30% of primary productivity estimated from 14C-fixation experiments and electron transport system-derived respiration rates. Metalimnetic and hypolimnetic DIC increase rates and porewater DIC gradients in hypolimnetic sediments indicated that remineralization of particulate organic carbon (POC) previously deposited sediments is a major source of DIC in the lake during summer. Summertime CO2 gas invasion balanced wintertime CO2 gas evasion and DIC and POC outflow balanced DIC and POC inflow rates, implying no net carbon burial in the sediments during 1980. This contrasts with the measured long-term sedimentation-rate-derived carbon burial rate of 800000 mole C per day. Year-to-year variability in summer primary production rates largely determines net gains or losses of C via CO2 gas exchange and sedimentation. (Author's abstract)

PRODUCTION OF PLANKTONIC BACTERIA IN LAKE MICHIGAN, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental

tion, Alli Arour, Mr. Otes Lase Environmental Research Lab. D. Scavis, G. A. Laird, and G. L. Fahnenstiel. Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 612-626, May 1986. 6 fig. 3 tab, 65 ref.

Descriptors: *Limnology, *Lake Michigan, *Bacteria, *Plankton, *Growth rates, *Carbon flux, Isotope studies, Statistics, Bacterial physiology, Deoxyribonucleic acid, Grazing losses, Ecology, Coefficient of variation, Mathematical studies.

cient of variation, Mathematical studies.

Bacterial production rates were estimated for the surface waters of a station 100-m deep in southeastern Lake Michigan during 1984. Production was calculated from incorporation of (3H-methyl)thymidine and from empirical conversion factors determined from dilution experiments performed throughout the study. The conversion factors (with typical coefficient of variation (C.V.) < 40%) varied between 4.7 and 18.3 x 10 to the 9th power cells produced per nanomole of thymidine incorporated into ice-cold tricholoracetic acid extracts. Estimates of bacterial exponential growth rates were between 0.05 and 0.24 per hour (C.V. typically < 50%) based on the empirical conversion factors. The growth estimates were much lower (0.004 to 0.020 per hour) when based on measured 47% thymidine incorporation into DNA and a theoretical conversion factor. The higher growth estimates are less certain due to the possible range of bacterial carbon content and growth efficiencies, but most of the higher growth estimates imply a bacterial carbon content and growth efficiencies, but most of the higher growth estimates imply a bacterial carbon demand higher than concurrent 14C-based primary production measurements. (Author's abstract') primary production mea W87-00565

METHOD FOR DETERMINING ENZYMATI-CALLY HYDROLYZABLE PHOSPHATE (EHP) IN NATURAL WATERS,

Warsaw Univ. (Poland). Dept. of Environmental Microbiology. For primary bibliographic entry see Field 5A. W87-00566

LONG RANGE VERTICAL MIGRATION OF VOLVOX IN TROPICAL LAKE CAHORA BASSA (MOZAMBIQUE), Max-Planck-Inst. fuer Limnologie zu Ploen (Ger-many, F.R.).

Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 650-653, May 1986. 3 fig, 13 ref.

Descriptors: *Limnology, *Vertical migration,
*Volvox, *Lake Cahora Bassa, Daily patterns,
Phosphorus, Plant physiology, Freshwater algae,

Volvox sp. in Lake Cahora Bassa, Mozambique, performed diel vertical migrations, the amplitude of which greatly exceeded those reported for other freshwater algae. Migration velocities even exceed the maxima attained by marine dinoflagellates. The daytime depth distribution is attributed to the light regime and the nighttime depth distribution to P intake in deeper water layers. (Author's abstract) W87-00567 W87-00567

ORGANIC CARBON IN THE CAURA RIVER.

VENEZUELA, Cornell Univ., Ithaca, NY. Ecosystems Research

W. M. Lewis, J. F. Saunders, S. N. Levine, and F. H. Weibezahn.

Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 653-656, May 1986. 1 fig, 12 ref. NSF Grant BSR 83-15410.

Descriptors: *Dissolved organic carbon, *Caura River, *Particulate organic carbon, Venezuela, Discharge, Homeostasis.

Water samples were obtained weekly for 2 yr near the mouth of the Caura River, Venezuela. Concentrations of dissolved organic carbon were essentially static despite a 10-fold seasonal change in discharge. Particulate carbon showed an unexpected, but relatively weak, inverse relationship to discharge. Yield of total organic carbon (12.3 g C/sq m/year) was higher than would have been expected from the literature. Yield can be predicted accurately from discharge because of the strong homeostasis in concentration of dissolved organic carbon. (Author's abstract)

FRECISE THERMODYNAMIC PROPERTIES FOR NATURAL WATERS COVERING ONLY THE LIMMOLOGICAL RANGE, National Sun Yat-Sen Univ., Kaohsiung (Taiwan). C. A. Chen, and F. J. Millero. Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 657-662, May 1986. 5 tab, 15 ref. DOE Subcontract 19X-39608C under DE-ACO5-84 OR21400, Office of Naval Research N00014 80-0004, NSF OCE 81-20659, National Science Council of the Republic of China NSC 74-0407-M110-01.

Descriptors: *Water properties, *Physical proper-ties, *Density, *Thermal expansibility, *Tempera-ture, *Specific heat, *Compressibility, *Sound speed, *Freezing point, *Adiabatic temperature gradient, *Static stability, Thermodynamics,

Equations are given to calculate, over the range 0-0.6 salinity, 0-30 C, and 0-180 bars, the following properties: density, thermal expansibility, temperature of maximum density and minimum specific volume, isothermal compressibility, specific heat at constant pressure, specific heat at constant volume, sound speed, adiabatic compressibility, freezing point, adiabatic temperature gradient, and static stability. (Author's abstract)

Group 2H-Lakes

W87-00569

EXPERIMENTAL DISTURBANCE AND THE MAINTENANCE OF SPECIES DIVERSITY IN A STREAM COMMUNITY, North Carolina Univ. at Chapel Hill. Dept. of

Oecologia OECOBX, Vol. 67, No. 1, p 90-97, August 1985. 1 fig, 4 tab, 44 ref. NSF Grant DEB-8206910.

Descriptors: *Species diversity, *Streams, *Experimental disturbance, *Community structure, *Macroinvertebrates, New Hope Creek, North Carolina, Monitoring, Colonization, Bed load, Cobbles.

Recovery of macroinvertebrates was monitored in New Hope Creek, North Carolina, after experimental disturbances at differing frequencies. Patches of cobbles were tumbled 0, 1, or 2 times in a 6-week span. Most taxa showed major reductions in population density immediately following the disturbance. The percent reduction of a given taxon in disturbed versus control patches ranged from 12.4-95%. Recovery to near normal population levels was achieved in about 4 weeks. A second disturbance caused similar population reductions as the first one, and delayed the recovery. Populations quickly regained their predisturbance densities. Rare taxa did not selectively colonize disturbed patches. Disturbance is a major determinant of lotic community structure and species diversity. of lotic community structure and species diversity.
(Author's abstract)
W87-00572

FRESHWATER SNAIL DIVERSITY: EFFECTS OF POND AREA, HABITAT HETEROGENE-ITY AND ISOLATION, Lund Univ. (Sweden). Dept. of Animal Ecology. C. Bromark.

Oecologia OECOBX, Vol. 67, No. 1, p 127-131, August 1985. 5 fig, 3 tab, 38 ref.

Descriptors: *Snails, *Freshwater, *Ponds, *Species diversity, *Habitat heterogeneity, *Dispersal, Multiple regression analyses, Macrophytes, Birds, Immigration, Extinction, Microhabitats, Predation.

A large number of eutrophic ponds in southern Sweden were surveyed for the presence of freshwater gastropods. The homogeneous geological background of the area suggests that physicochemical factors had little influence on the distribution of snalls. There was a significant, positive regression between pond area and the number of gastropod species in a pond, but the regression only explained a minor part of variation in species numbers. Multiple regression of an extended number of variables associated with habitat complexity and dispersal indicated that, in addition to area, macrophyte diversity and the mean number of gastropods in the five closest ponds (S sub 5) were important in explaining the distribution of gastropods. An increase in the number of microhabitats and refuges from predators. S sub 5 probably influences A large number of eutrophic ponds in southern species increases the number of microhabitats and refuges from predators. S sub 5 probably influences the disperaal rates between ponds. The gastropods in this locality are thought to have dispersal modes besides aerial dispersal with birds; this fact probably increases the immigration rates and/or decreases the extinction rate. (Author's abstract)

TEMPERATURE-CONTROLLED MATER AGE DORMANCY AND POSTFLOOD HATCHING OF ISOTOMA VIRIDIS (COL-LEMBOLA) AS FORMS OF ADAPTATION TO ANNUAL LONG-TERM FLOODING, Frankfurt Univ. (Germany, F.R.) J. C. Tamm.

Oecologia OECOBX, Vol. 68, No. 2, p 241-245, January 1986. 1 fig, 1 tab, 33 ref.

Descriptors: *Isotoma viridis, *Temperature, *Flooding, *Seasons, *Reproduction, *Eggs, *Dormancy, *Adaptation, Hatching, Eder Reser-

Incubation experiments with eggs of an Isotoms viridis population from Eder Freshwater Reser-

voir, Germany, where April to July flooding occurs, and field observations show that temperature controls both underwater egg dormancy and immediate postflood hatching. With constant experimental temperatures of > 14 C, almost all eggs are nondormant; dormancy is established below 15 C, but embryonic development is completed. Of the environmental factors that change drastically at the end of submergence (light, turgor pressure, oxygen, a.o.), only temperature acts as a hatching rigger. Hatching of the previously dormant eggs occurs at a constant threshold temperature of 16 C, mainly within 2-20 days after temperature elevation, but most of the eggs need even higher temmainly within 2-20 days after temperature eleva-tion, but most of the eggs need even higher tem-peratures to hatch. Remaining eggs were partly stimulated to hatch by cooling to 7 C for some days and rewarming. Above the threshold temper-ature (in warm summers) individuals can hatch under water and survive submerged for 10-15 days. They can survive even longer in the natural habitat if emergent structures allow them to climb to the water surface. (Rochester-PTT)

IMPORTANCE OF DISSOLVED ORGANIC MATTER IN THE NUTRITION OF ZOO-PLANETON IN SOME LAKE WATERS, Helsinki Univ., Lammi (Finland). Lammi Biologi-

Helsinsi Only, Lamini (America) cal Station. K. Salonen, and T. Hammar. Oecologia OECOBX, Vol. 68, No. 2, p 246-253, January 1986. 6 fig, 4 tab, 36 ref.

Descriptors: *Limnology, *Dissolved organic matter, *Zooplankton, *Nutrition, *Lakes, *Iso-tope studies, *Diets, *Carbon-14, *Microflagellate algae, *Light, Heterotrophic metabolism, Brown-water lakes, Finland, New Zealand. *Dissolved organic

A steady-state, inorganic radiocarbon tracer technique was used to study the original source of C in zooplankton. Ovigerous zooplankton individuals collected from one of six Finnish brown-water lakes or Lake Okaro, New Zealand, were introduced into a filtered lake water medium containing added inorganic radiocarbon, and the radioactivity: C ratio was kept constant throughout the experiment. Dissolved organic matter seemed radioactivity:Č ratio was kept constant throughout the experiment. Dissolved organic matter seemed to be an important food source for zooplankton, particularly in highly humic lakes. Zooplankton from these lakes could grow and reproduce in experiments started with filtered lake water and conducted in complete darkness. Microflagellate algae reproduced equally well in both light and darkness, indicating the importance of heterotrophic metabolism in their nutrition. Although no direct observations of zooplankton food were made, it appears likely that heterotrophic flagellates play an important role as a food of zooplankton food mine waters. (Rochester-PTT) W87-00576

EFFECTS OF MICROCRUSTACEANS ON SUC-CESSION AND DIVERSITY OF AN ALGAL MI-CROCOSM COMMUNITY,

Oregon Univ., Eugene. Dept. of Biology. R. L. Peer.

Oecologia OECOBX, Vol. 68, No. 2, p 308-314, January 1986. 1 fig, 5 tab, 51 ref. NIH Grant TM-T-32-07257.

Descriptors: "Herbivores, "Microcrustacea, "Microcrossms, "Species diversity, "Succession, "Green algae, "Blue-green algae, Grazing, Rotenone, Nutrient recycling, Plant physiology, Mortality.

The effects of herbivorous microcrustac algal succession and diversity were studied in three experiments employing 200 ml freshwater microcosms. Two experiments used laboratory microcosms in growth chambers. Rotenone was used to which is a grown champers. Rotenone was used to kill the microcrustaceans in one-half the cultures; diversity (H7) and succession were monitored over a 60-day period. The third experiment used similar microcosms, but was conducted outdoors. In this experiment, microcrustaceans became extinct in some cultures from mechanical disturbances. In all three experiments, succession from a com dominated by green algae to one dominated by blue-green algae was significantly slower when microcrustaceans were present. Diversity was

higher in grazed cultures at some times during succession, but not at all times. The dynamics of succession, but not at all times. The dynamics of diversity during succession appeared to be governed principally by the change in the relative frequency of green and blue-green algae, rather than by dynamics of individual species. Nutrient recycling by microcrustaceans may favor green algae, partially mitigating mortality of green algae from grazing. (Author's abstract)

W87-00578

MODELING OF PHYTOPLANKTON IN SAGINAW BAY: I. CALIBRATION PHASE, Environmental Research Lab., Narragansett For primary bibliographic entry see Field 5B.

MODELING OF PHYTOPLANKTON IN SAGI-NAW BAY: II. POST-AUDIT PHASE, Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5B.

SEGMENTAL HYDRAULIC SIMILARITY IN ONE-DIMENSIONAL RETARDING FLOW, For primary bibliographic entry see Field 2J. W87-00623

MACROINVERTEBRATE PRODUCTION IN A SOUTHEASTERN UNITED STATES BLACK-WATER STREAM,

Virginia Commonwealth Univ., Richmond. Dept. of Biology.

L. A. Smock, E. Gilinsky, and D. L. Stoneburner. Ecology ECOLAR, Vol. 66, No. 5, p 1491-1503, October 1985. 1 fig, 5 tab, 39 ref. DOI CX 5000-0-

Descriptors: *Macroinvertebrates, *Streams, *Limnology, *Swamps, *South Carolina, *Aquatic productivity, Invertebrates, Blackwater streams, Productivity, Benthic fauna, Lotic environment.

Macroinvertebrate production was studied by replicated monthly sampling of five different substrate types at three sites in a second-order South Carolitypes at three sites in a second-order South Carolina blackwater stream. Both community-level and species-specific production in the major habitats found above, within, and below a swamp were determined. Total stream production at the three sites was determined using data on habitat availability and habitat-specific production which varied among habitats at each site. Production on snags was at least twice as high as that found in any other habitat. Production in the muddy stream banks was higher than in sandy, main channel sediments, but was similar to levels found in the silty main channel sediments within the swamp. Production in leaf packs caught on snags was the silty main channel sediments within the swamp. Production in leaf packs caught on snags was the lowest found in any of the High production on the snags was due to filter-feeders and collector-gatherers. The hydropsychid caddisfly Macronema carolina (dry mass of 4.90 g/sq m/yr) dominated upstream production on the snags, while the chironomid Tanytarsus sp. was the main filter-feeder on snags within and downstream of the swamp. Collector-gatherers dominated production in the other habitats. Highest production in all habitats was found above the swamp. Filter-feeders production, which was lower within and below the swamp, exhibited the greatest site differences. duction, which was lower within and below the swamp, exhibited the greatest site differences. Total annual stream production, incorporating production from all habitats adjusted according to habitat availability, dropped from 4.11 g/sq m at the upstream site, to 3.09 g/sq m within the swamp, to 1.96 g/sq m below the swamp. The swamp, to 1.96 g/sq m below the swamp. The swamp to 1.96 g/sq m below the state of 44, 39, and 42% of production at the three sites, re-39, and 42% of production at the three sites, respectively, supported the greatest proportion of total macroinvertebrate production of any habitat. Snag production contributed 32, 35, and 28% of total production at the three sites. Total production from this habitat and the main channel sediments decreased within and below the swamp. From 40 to 53% of total stream macrionvertebrate production was due to collector-gatherers (especially Polypedilum digitifer, Eurylophella doris, and Tubificidae), while filter-feeders accounted for

Lakes-Group 2H

13-34% of total stream macroinvertebrate production. Shredders accounted for < 5% of total production at each site within this fully canopied deciduous forest headwater stream. (Author's ab stract) W87-00668

PARTITIONING LIGHT ATTENUATION IN AN ACIDIC LAKE, Upstate Freshwater Inst., Inc., Syracuse, NY. For primary bibliographic entry see Field 5C. W87-00691

STABLE CARBON AND NITROGEN ISOTOPE TRACERS OF TROPHIC DYNAMICS IN NAT-URAL POPULATIONS AND FISHERIES OF THE LAHONTAN LAKE SYSTEM, NEVADA, Carnegie Institution of Washington, DC. Geo-physical Lab. For primary bibliographic entry see Field 5C. W87-00692

PRECIPITATION CHEMISTRY AND CHEMICAL LIMNOLOGY OF FERTILIZED AND NATURAL LAKES AT SAQVAQJUAC, N. W. T., Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B. W87-00694

CURRENT VELOCITY IN STREAMS AND THE COMPOSITION OF BENTHIC ALGAL MATS, Kent State Univ., OH. Center for Library Studies. M. A. Reiter, and R. E. Carlson. Canadian Journal of Fisheries and Aquatic Sciences CJFSBX, Vol. 43, No. 6, p 1156-1162, June 1986. 6 fig, 3 tab, 17 ref.

Descriptors: *Aquatic plants, *Benthic flora, *Flow rate, Algae, Streams, Water velocity, Cur-

Water velocity is commonly accepted as a factor in the development of benthic algal mats in streams. Within a stream, two different zones of velocity are observed: the free-water velocity of the open water and the local velocity near the stream substrate. A closed laboratory flume system was used to observe the taxonomic composition of bethic algal mats and corresponding changes in the local velocities under different free-water velocities. As the algal mat developed under each experimental velocity, local velocities diminished and eventually became equal in all sections, while free-water velocities remained different. After a period of maximum taxonomic diversity during the first 2 wk of mat development, taxonomic composition, relative abundance of the tax, and dry weight biomass became increasingly similar in the three velocity regimes, although the mats appeared different. Differences in composition and morphology in natural algal mats may not result from differences in current velocity, and the idea of a closed monolayer algal mat may not be appropriate in all situations. (Author's abstract) algal mat may not be appropriate in all situati (Author's abstract) W87-00695

EFFECTS OF ENVIRONMENTAL VARIABLES ON GROWTH RATES AND PHYSIOLOGICAL CHARACTERISTICS OF LAKE SUPERIOR

TOTONTO UNIV. (Ontario). Div. of Life Sciences. C. Nalewajko, and D. Voltolina. Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 43, No. 6, p 1163-1170, June 1986. 4

Descriptors: *Lakes, *Phytoplankton, Plankton, Aquatic plants, Growth rates, Plant growth, Lake Superior, Biovolume, Isothermal mixing, Temperature, Light, Seasonal variation, Regression analysis, Statistical analysis.

Phytoplankton taxonomic composition and biovo-lume, assimilation numbers, phosphorus kinetics, as well as some physical and chemical variables were measured on 37 occasions during six cruises on Lake Superior during May 1980 - October 1981. A

larger number of significant differences were de-tected between thermally stratified and isothermal stations than between inshore or offshore, or among seasons. Phytopiankton from isothermal waters was characterized by lower assimilation numbers and biovolume, showed symptoms of adaption to a lower light regime, and was less phosphorus deficient than populations from ther-mally stratified waters. The lower growth rates and the outcome of stepwise multiple regression analyses suggest that phytopiankton growth during isothermal mixing is limited primarily by light. (Author's abstract) W87-00696

EXPERIMENTAL STUDY OF THE IMPACT OF BLUEGILL (LEPOMIS MACROCHIRUS) AND LARGEMOUTH BASS (MICROPTERUS SALMOIDES) ON POND COMMUNITY STRUCTURE,

Texas Christian Univ., Fort Worth. Dept. of Biol-

ogy.
K. D. Hambright, R. J. Trebatoski, R. W.
Drenner, and D. Kettle.
Canadian Journal of Fisheries and Aquatic Science
CJFSBX, Vol. 43, No. 6, p 1171-1176, June 1986. 7
fig, 1 tab, 34 ref. TCU-RF Grant 5-23701.

Descriptors: *Limnology, *Fish, *Bluegills, *Bass, *Nutrients, *Ponds, Largemouth bass, Ecosystems, Ecological effects, Daphnia, Algae, Phosphorus, Ecology, Aquatic life, Insects, Plankton, Nitrogen.

Ecology, Aquatic life, Insects, Plankton, Nîtrogen. Community impacts of bluegill (Lepomis macrochirus) and largemouth bass (Micropterus salmoides) were examined in a summer experimental pond study of factorial design with four treatment combinations (fiahless, bluegill, largemouth bass, and bluegill with largemouth bass). Ceriodaphnia reticulata, Daphnia pulicaria, Chaobrus sp., Volvox sp., anisopteran and zygopteran nymphs, and dissolved oxygen levels were suppressed in the presence of bluegill. Diaptomus sp., Concoliioides sp., Cyclotella sp., Navicula sp., Occystis sp., Anabaena sp., Ceratium sp., algal fluorescence, turbidity, 5- to 12.7- micro m particles, and total phosphorus and total nitrogen were enhanced in the presence of bluegill. Daphnia pulicaria was enhanced and Cyclotella sp. and Occystis sp. were suppressed in the presence of largemouth bass. The effects of the two fish were not independent, as indicated by significant bluegill x largemouth bass interactions for some plankton taxa. Little evidence was found of bluegill impacts being reversed by largemouth bass. While total bluegill biomass was reduced and bluegill biomass distributions were shifted toward larger individuals, bluegill remained in the presence of largemouth bass. (Author's abstract) thor's abstract) W87-00697

SEASONAL INORGANIC CARBON AND NITROGEN TRANSPORT BY PHYTOPLANK-TON IN AN ARCTIC LAKE, Alaska Univ., Fairbanks. Inst. of Marine Science. S. C. Whalen, and V. Alexander.
Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 43. No. 6, p 1177-1186, June 1986. 4 fig, 4 tab, 35 ref. NSF Grant DPP79-00815.

Descriptors: *Limnology, *Phytoplankton, *Lakes, *Toolik Lake, Carbon, Nitrogen, Arctic zone, Nitrates, Ammonium, Inorganic compounds, Dissolved inorganic carbon, Alaska, Euphotic

Euphotic zone profiles of dissolved inorganic carbon (DIC = CO2 + HCO3(-) + CO3(-2)) and nitrogen (DIN = NO3(-) + NH4(+)) transport were taken from Toolic Lake, Alaska, at approximately 10-d intervals through 100-d growing seasons in 1980 and 1981. Rates of DIC transport ranged from <0.2 to 7.8 micro mol/L/d, with the maximum always at 0-1 m. Nitrate and ammonium transport rates ranged from <0.1 to 3 and 0.4 to 8 nanomol/L/d, with the vertical pattern variable. For the 1980 and 1981 investigative periods, DIC transport was 622 and 504 mmol/sq m(7.5 and 6.0 C/sq m), making Toolik one of the most oligotrophic lakes ever recorded. DIN transport for the respective years was 34 and 41 mmol/sq m, giving

molar C/N transport ratios of 18 and 12. For both years, NO3(-) was <20% of total DIN transport. Half-saturation constants for NO3(-) and NH4(+) transport were similar, averaging 0.11 + or - 0.08 and 0.15 + or - 0.13 micro mol/L. During the ice-free period, mean turnover times were also comparable at 6.3 + or - 8.2 (NO3(-) and 2.6 + or - 1.2 d NH4(+), while relative preference indices for both nutrients were often near 1.0, indicating a transport equitable with availability. The total data show a population well adapted to utilize consistently low ambient concentrations of NO3(-) and NH4(+)(0.05 - 0.20 micro mol /L) in the ice free season, but incapable of exploiting elevated (2-3 micro mol/L) under-ice levels of NO3(-). (Author's abstract) W87-00698

PHOSPHORUS RELEASE PROCESSES IN NEARSHORE SOUTHERN LAKE MICHIGAN, National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environment Research Lab. For primary bibliographic entry see Field 5B. W87-00699

MICROHABITAT-PREFERENCE CURVES OF BLACKFLY LARVAE (DIPTERA: SIMULII-DAE: A COMPARISON OF THREE ESTIMA-TION METHODS, McGill Univ., Montreal (Quebec). Dept. of Biol-

A. Morin, P. -P. Harper, and R. H. Peters. Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 43, No. 6, p 1235-1241, June 1986. 4 fig, 2 tab, 16 ref.

Descriptors: *Aquatic life, Streams, Statistical analysis, *Habitats, Aquatic habitats, Larvae, Re-gression analysis, Incremental analysis, Polynomial regression analysis, Multiple regression analysis.

Three analytical techniques are available to describe the observed resonse of stream-dwelling organisms to variations in their physicochemical environment: the incremental method, polynomial regression on a single factor, and multiple regression. The efficacy of these tools as descriptors of the responses has not been compared. The three methods were used to describe density and microhabitat-preference curves for Prosimulium mixtum/fuscum, Stegopterna mutata, and Simulium aureum in response to distance from the lake, current velocity, and water depth in a stream draining a Laurentian lake. The incremental method yielding the least precise estimates of desisty and biased estimates of optimal current velocity for two of the three species; multiple regression sity and biased estimates of optimal current velocity for two of the three species; multiple regression yielded the most precise estimates of density and unbiased estimates of optimal conditions, whereas polynomial regression on a single factor was intermediate. From this comparison, it is suggested that the multiple-regression approach to estimate microhabitat-preference curves be used in developing optimal management strategies. It is furthermore suggested that rare species should be excluded from such analysis because of the low precision of density estimates for rare organisms. (Author's abstract) stract) W87-00700

THEORY, PRACTICE, AND EFFECTS OF MYSIS RELICIA INTRODUCTIONS TO NORTH AMERICAN AND SCANDINAVIAN

Trent Univ., Peterborough (Ontario). Dept. of Bi-

D. C. Lasenby, T. G. Northcote, and M. Furst. Canadian Jourani of Fisheries and Aquatic Science CJFSBX, Vol. 43, No. 6, p 1277-1284, June 1986. 3 fig, 1 tab, 48 ref.

Descriptors: *Lakes, *Limnology, *Ecosystems, Aquatic animals, Crustaceans, North America, Scandinavia, Fish, Productivity, Benthic fauna.

Fisheries biologists have greatly altered the natural distribution of the crustacean Mysis relicta by introducing it into many lakes in both North Amer-

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ica and Scandinavia to serve as a supplementary food source for fish. The original concept of Mysis as a deepwater benthic organism which remains isolated in the profundal zone of lakes needs to be modified to include its downstream dispersal capabilities. After introduction to a lake, Mysis will most probably reach all lakes in the downstream watershed. Recent studies indicate that rates of increase of introduced Mysis populations are probably food and temperature related. Introduced populations have been shown to modify benthic, phytoplankton, zooplankton, and fish communities. Most Mysis introductions have taken place without consideration of general criteria suggested for introduced species. (Author's abstract) W87-00703

DISPERSAL IN POND SNAILS: POTENTIAL ROLE OF WATERFOWL,
Alberta Univ., Edmonton. Dept. of Zoology.

D. A. Boag.
Canadian Journal of Zoology CJZOAG, Vol. 64,
No. 4, p 904-909, April 1986. 3 fig. 3 tab, 27 ref.
Natural Sciences and Engineering Research Council Grant 2010.

Descriptors: *Snails, *Ponds, *Waterfowl, Ecosystems, Alberta, Birds, Aquatic populations, Surviv-

Young pond snails of three species (Lymnaea stag-nails, Stagnicola elodes, and Helisoma trivolis) were allowed free access to waterfowl feathers floating on the surface of shallow containers. Snails adhering to the feathers were subjected to simulated flight conditions by placing them in an air stream. The size of these snails, the length of time they adhered to the feathers while in the air stream. they adhered to the feathers while in the air stream, and their survivability for various lengths of time under these conditions were recorded. Those smalls that adhered to the feathers were mainly small individuals (<2.5 mm long in all three species). The proportion that remained clinging to the feathers declined sharply with time: after 15 min of exposure only 6% of L. stagnalis, 18% of S. elodes, and 15% of H. trivolvis remained. Survivability also declined with exposure to the simulated flight conditions: after 15 min only 50% of L. stagnalis, 23% of S. elodes, and 15% of H trivolis were still alive. Larger individuals tended to survive better than smaller ones for any given exposure time, but they also tended to fall off the feathers sooner than smaller ones no snall more than 3 mm long was recorded adhering to the than 3 mm long was recorded adhering to the feathers for more than 4 min under the test condifeathers for more than 4 min under the test conditions of simulated flight (air speed of 41 km/h). The data recorded suggest that despite a low proportion of the snail population adhering to the feathers (1% of those available at any given time) and the relatively high rates of loss, either by falling off the feathers or dying in situ after adhering, the probability of successful dispersal for distances up to 10 km remains high (a mallard flying for 15 min at 41 km/h was deemed capable of carrying at least three surviving individuals of any of the species tested over a distance of about 10 km). Of the three species tested, S. elodes had the greatest probability of successful dispersal, which may explain its almost ubiquitous distribution in the water bodies of central Alberta. (Author's abstract) stract) W87-00706

FLOW REGIME, JUVENILE ABUNDANCE, AND THE ASSEMBLAGE STRUCTURE OF STREAM FISHES, North Dakota Univ., Grand Forks. Dept. of Biol-

ogy. I. J. Schlos

Ecology ECOLAR, Vol. 66, No. 5, p 1484-1490, October 1985. 3 fig. 3 tab, 38 ref, append. EPA Grant R806391, NSF Grant BSR-8320371.

Descriptors: *Fish, *Streams, Flow characteristics, Ecosystems, Illinois, Recruitment, Species-area relationships, Species composition, Juvenile abun-

The assemblage of fishes in a second-order stream in east-central Illinois was compared through seine sampling for two years with distinctly different

flow regimes. In both years adult (age > 0) fish most abundant in late spring and early summer while juvenile (age 0) abundance peaked in late summer or autumn. Total density of adult fish changed little between years but large changes in juvenile abundance occured between years in association with differences in hydrologic regime. High stream discharge had little influence on abundance of juvenile suckers and darters, but some minnow species greatly increased in juvenile abundance during stable to low conditions. The greatest increase in juvenile abundance occurred among species with prolonged breeding seasons: bluntnose minnow (Pimephales notatus) and striped shiner (Notropis chrysocephalus). Increased juvenile abundance during stable flow conditions resulted in increased species richness in small habitat patches and annual changes in species composition of the community. Models of fish assemblages in small streams need to incorporate ontogenetic small streams need to incorporate ontogenetic changes in the role of stochastic environmental variables in regulating the population size of component species. (Author's abstract)
W87-00707

SURVIVAL, GROWTH AND REPRODUCTION OF THE IMPORTED AMPULLARID SNAIL MARISA CORNUARIETIS IN CENTRAL

SUDAN, Blue Nile Health Project, Wad Medani (Sudan). For primary bibliographic entry see Field 5G. W87-00718

SIMULATING THE FLOOD MITIGATION ROLE OF WETLANDS, University of Occupational and Environmental Health, Kitakyushu (Japan). Dept. of Post Gradu-

For primary bibliographic entry see Field 2E. W87-00743 ate Education

PHYSIOLOGICAL ECOLOGY OF THE BLOOM-FORMING ALGA CHRYSOCHRO-MULINA BREVITURRITA (PRYMNESIOPHY-THE CEAE) FROM LAKES INFLUENCED BY ACID PRECIPITATION. University of Western Ontario, London. Dept. of

For primary bibliographic entry see Field 5C. W87-00756

PALAEOLIMNOLOGICAL AND LIMNOGEO-CHEMICAL FEATURES IN THE SEDIMENTA-RY RECORD OF THE POLLUTED LAKE LIP-PAJARVI IN SOUTHERN FINLAND, Helsinki Univ. (Finland). Dept. of Geology. For primary bibliographic entry see Field 5B. W87-00770

HYDROGEOCHEMISTRY, CONTAMINANT TRANSPORT AND TECTONIC EFFECTS IN THE OKPOSI-UBURU SALT LAKE AREA OF IMO STATE, NIGERIA, Anambra State Univ. of Technology, Awka (Nige-

For primary bibliographic entry see Field 5B. W87-00775

DISTRIBUTION OF POTENTIAL MACROFOS-SILS IN LAKE DOBSON, TASMANIA, Tasmania Univ., Hobart (Australia). Dept. of R. S. Hill, and N. Gibson. Journal of Ecology JECOAB, Vol. 74, No. 2, p 373-384, June 1986. 3 fig, 3 tab, 22 ref.

Descriptors: *Distribution patterns, *Macrofossils, *Lake Dobson, *Tasmania, Species composition, Distribution, Species diversity, Eucalyptus, Trees, Shrubs, Lake shores.

Lake Dobson is a small lake on south-central Tas-mania surrounded by tree and shrub-dominated sub-alpine evergreen vegetation. Most species present in the surrounding vegetation were recov-ered as leaves from the lake sediment, but the proportions of species changed rapidly between

samples, and an accurate reconstruction of the surrounding vegetation from these samples would be impossible except in terms of species present. Epacris scryptiliolia, a small, lakeside shrub, was overwhelmigly dominant in most sediment samples, and was strongly over-represented in relation in its importance in the surrounding vegetation. Eucalyptus coccifera, the dominant canopy tree species, was common directly below overhanging trees, but as the leaves sank rapidly they were virtually absent from the rest of the lake. E. coccifera was thus strongly under-represented in relation to its importance in the surrounding vegetation. Leaf remains were far more common in Lake Dobson than reproductive structures and could be more reliably identified. The most important features affecting leaf deposition in the lake were the prevailing wind direction, the presence of lakeside or overhanging vegetation, and leaf sinking rates. Decomposition of leaves is relatively slow in the lake. (Author's abstract)

TOPOGRAPHIC FLUCTUATIONS ACROSS A SPRING FEN AND RAISED BOG IN THE LOST RIVER PEATLAND, NORTHERN MIN-

Minnesota Univ., Minneapolis. Limnological Re-search Center. J. C. Almendinger, J. E. Almendinger, and P. H.

Glaser.
Journal of Ecology JECOAB, Vol. 74, No. 2, p 393-401, June 1986. 4 fig, 20 ref.

Descriptors: "Minnesota, "Fens, "Bogs, "Wetlands, "Topography, "Lost River, Surveys, Peat bogs, Topographic mapping, Surveying instruments, Altitude, Elevation, Surveys, Geography, Peat Soils.

A topographic survey was conducted with both laser and electronic levels across a spring fen, a raised bog, and the water track (fen) between them, in the Lost River Peatland of northern Minnesota. The survey demonstrated that the spring fen consisted of a peat mound whose alopes were steeper than that of the bog. Three successive surveys in 1982 and 1983 showed altitudinal surveys in 1982 and 1983 showed altitudinal changes in benchmarks fixed in trees relative to a base level on a power-line pylon located in the water track. Nearly all benchmarks rose, with the greatest rises occurring near the centers of the raised bog (11 cm) and spring fen (6 cm) in contrast to very slight rises across the water track. The most likely explanation for this altitudinal change is a swelling of the sub-surface peat in response to artesian fluid pressure generated by regional hydraulic gradients. Very precise determinations of altitude are thus possible with a laser or electronic level on an unstable peat substrate, providing great care is taken in surveying techniques. (Author's abstract) W87-00797

HYDROGEN ION BUFFERING OF CULTURE MEDIA FOR ALGAE FROM MODERATELY ACIDIC, OLIGOTROPHIC WATERS, University of Western Ontario, London. Dept. of Plant Sciences. J. D. Wehr, L. M. Brown, and I. E. Vanderelst. Journal of Phycology JPYLAJ, Vol. 22, No. 1, p 88-94, March 1986. 4 fig, 3 tab, 26 ref.

Descriptors: *Culture media, *Algae, *Acidic water, *Oligotrophic lakes, *Buffers, Culturing techniques, Hydrogen ion concentration, 3,3-Dimethylglutaric acid, HEPES, MES.

Five hydrogen ion buffers were compared for their usefulness in regulating pH in a model oligotrophic, moderately acidic (pH 6.0) algal growth medium. These were 3,3-dimethyligutaric acid (DMGA), tricarballylic acid (TCA), trans-aconitic acid (tAA), N-2-hydroxyethylpiperazine-N-2-ethanesulfonic acid (MEPES), and 2-(N-morpholino) ethanesulfonic acid (MES). All except HEPES limited the reduction of pH in an NH4(+) based medium during growth of Chrysochromulina breviturrita to less than 0.12 units, compared with more than 2 units in an unbuffered medium. Long

term growth of C. breviturrita in these media was significantly inhibited by TCA and tAA. MES controlled pH with the minimum amount of NaOH (1.0 mM) added to the medium to adjust to pH 6.0. Four of five bacterial isolates were capable of utilizing tAA as a sole organic-C source, and no isolate could metabolize HEPES or MES. No significant differences were found in the maximum growth rates of six algal species from five classes in a medium with or without MES, although significantly greater cell yields of Ochromonas danica were obtained in the buffered medium. MES (pK sub a = 6.15) was considered to be the most useful buffer in the pH range 5.0-6.5, due to its biological inertness, buffering capacity, the minimal requirement for excess base to adjust pH, and its minimal metal complexing ability. (Author's abstract)

IRON-MEDIATED CHANGES IN THE GROWTH OF LAKE ERIE PHYTOPLANKTON AND AXENIC ALGAL CULTURES, State Univ. of New York Coll. at Fredonia. Environmental Resources Center.

T. A. Storch, and V. L. Dunham.
Journal of Phycology PYYLAJ, Vol. 22, No. 2, p 109-117, June 1986. 4 fig, 4 tab, 38 ref. DOI B-O-ZNY.

Descriptors: *Phytoplankton, *Lake Erie, *Iron, *Algae, *Plant growth, *Culturing techniques, Aquatic plants, Plankton, Heavy metals, Photosynthesis, Culture media, Water pollution effects, Nutrients, Phosphons.

trients, Phosphons.

The effect of iron enrichment on algal growth and photosynthesis was investigated using natural assemblages of Lake Erie phytoplankton and axenic cultures of Anabena, Scenedesmus, and Selenastrum. Cell yield and photosynthesis were frequently inhibited in the presence of unchelated iron over the range of 3.6 to 53.7 micromolar iron as FeCl3. In lake water and in a defined medium with low nutrient concentrations, the degree of inhibition by iron could be reduced by chelating the iron with EDTA or by enriching the cultures with phosphorus. The EDTA reduced the ability of the ferriciron to remove soluble phosphorus from the media, and reduced iron uptake by axenic cultures of A. flos-aquae. These data support the hypothesis that additions of EDTA to low-nutrient media may serve to stimulate algal growth in the presence of iron by preventing the iron from altering extracellular concentrations of soluble ions essential for algal metabolism. In media with high nutrient concentrations, the soluble phosphorus concentration was not appreciably altered by either EDTA-chelated or unchelated iron enrichment (0.9 to 53.7 micromolar). Instead, the observed enhancement of cell yield by EDTA-chelated iron in nutrient rich media appeared to be due to the direct effect of iron on intracellular metabolic processes. (Author's abstract) thor's abstract) W87-00801

GROUNDWATER FLOW INTO LAKE MICHI-GAN FROM WISCONSIN, Wisconsin Univ.-Milwaukee. Dept. of Geological For primary bibliographic entry see Field 2A. W87-00813

2I. Water In Plants

ADVANCES IN ECOLOGICAL RESEARCH: VOLUME 12. For primary bibliographic entry see Field 6G. W87-00039

ZONATION OF PLANTS IN FRESHWATER LAKES, Saint Andrews Univ. (Scotland). Dept. of Botany. D. H. N. Spence. IN: Advances in Ecological Research: Volume 12, Academic Press, London, England. 1982. p 37-125, 28 fig, 11 tab, 212 ref, 1 append.

Descriptors: *Zonation, *Zoning, *Lakes, *Aquatic plants, Light intensity, Light penetration, Densi-

ty stratification, Thermal stratification, Turbulent flow, Boundary layers, Laminar flow, Erosion, Deposition.

Deposition.

A critical review is presented of factors controlling the zonation of freshwater plants. Groups of plants which are classed as macrophytes, and comprise aquatic vegetation, are defined, and their overall depth distribution is discussed. Specific examples are then provided of the zonation of vegetation in a range of lakes, particularly to emphasize the distinction between environmental factors (or variables), varying solely in the vertical plane and those that have both vertical and horizontal components. These habitat variables are: 1) vertical environmental variables (underwater light climate, attenuation and attenuation coefficients, underwater spectral density, and density gradients, thermal stratification and pressure), and; 2) vertical and horizontal environmental variables (turbulent motion, molecular motion in the boundary layer or laminar sub-layer, and erosion, sorting and depoistion in lakes). This distinction underlies the author's causal analysis of zonation. (See also W87-0039) (Lantz-PTT)

COMPARISON OF EXPERIMENTAL DESIGNS TO DETERMINE EFFECTS OF ACIDIC PRECIPITATION ON FIELD-GROWN SOY-BEANS, Brookhaven National Lab., Upton, NY. Dept. of

Energy and Environment.
For primary bibliographic entry see Field 5C.
W87-00043

WETLANDS OF THE NEW JERSEY PINE BARRENS: THE ROLE OF SPECIES COMPOSITION IN COMMUNITY FUNCTION, Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies. For primary bibliographic entry see Field 2H. W87-00173

MICROSITE ABUNDANCE AND DISTRIBU-TION OF WOODY SEEDLINGS, IN A SOUTH CAROLINA CYPRESS-TUPELO SWAMP, Savannah River Ecology Lab., Aiken, SC. For primary bibliographic entry see Field 2H. W87-00175

CONTINUOUS MONITORING OF PLANT

WATER POTENTIAL,
Commonwealth Scientific and Industrial Research
Organization, Orifith (Australia). Centre for Irrigation Research.
N. L. Schaefer, E. S. Trickett, A. Ceresa, and H.

D. Barrs. Plant Physiology Vol. 81, No. 1, p 45-49, May 1986. 7 fig, 22 ref.

Descriptors: *Plant water potential, *Irrigation, *Sensors, Australia, Soybeans, Safflowers, Sunflowers, Wheat, Dewpoint, Hygrometer.

Plant water potential was monitored continuously with a Wescor HR-33T dewpoint hygrometer in conjunctin with a L51 chamber. This commercial instrument was modified by replacing the AC-DC mains power converter with one stabilized by zener diode controlled transistors. The thermocouple sensor and electrical lead needed to be thermally insulated to prevent spurious signals. For rapid response and faithful tracking a low resistance for water vapor movement between leaf and sensor had to be provided. This was effected by removing the epidermis either by peeling or abrasion with fine carborundum clott. The crop plants that were studied included: sunflower, safflower, soybean, and wheat. Water uptake by the plant mirrored that for water potential changes including times when plant water status was undergoing cyclical changes. These experiments were conducted under conditions of constant temperature. It is concluded that water potential can be monitored continuously, provided: the power supply is smooth and stable, the sensor and lead are well insulated thermally, and there is a low resistance pathway for water (vapor) between plant and thermocouple. (Alexander-PTT)

W87-00188

CONSUMPTIVE USE AND WATER REQUIRE-MENT OF SOYBEANS,

Central Soil and Water Conservation Research and Training Inst., Dehra Dun (India). Div. of Land and Water Resources. S. P. Bhardwaj.

Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 112, No. 2, p 157-163, May 1986. 2 tab, 3 fig, 7 ref. USDA, Science and Education Administration Grant No. PL-480.

Descriptors: *Soybeans, *Hydrologic cycle, *Water use efficiency, Rainfall, Runoff, Seepage, Soil moisture, Evapotranspiration, Dew, Irriga-

Various components of the hydrologic cycle (rainfall, runoff, seepage, soil moisture and evapotranspiration) were measured daily in soybean plot, grown in a weighing-type lysimeter consisting of a 120 cm x 120 cm x 120 cm undisturbed soil monolith and sensitivity of 0.14 mm of water. Soil was always kept at more than 75% of the total available soil moisture by rainfall or irrigation. Soybeans of 17 weeks duration received 923 mm rainfall, 12 mm dew and 99 mm irrigation, and yielded 378 mm runoff, 190 mm deep percolation averaged for two crop seasons. There was a net gain of 71.5 mm soil profile recharge during 1981 and deplection of 29.4 mm during 1982. Average seasonal evapotranspiration was 545 mm. The water use efficiency was 63 kg/ha-cm grain with 3,419 kg/ha grain yield. The correlations of rainfall with runoff and seepage were significant. Water need after the ninth week of crop grown was jointly met from rainfall, soil moisture, and irrigation. The crop can be grown successfully with rainfall and soil profile water. However, the crop will face moisture stress the method of the contraction of the contraction of the profile water. However, the crop will face moisture stress at maturity and the next crop will face he weight. to grown successfully with rannal and soil profile water. However, the crop will face moisture stress at maturity and the next crop will not be possible without irrigation because of depleted soil moisture. Runoff, if stored in a pond, can fully satisfy the water needs of soybeans and partially satisfy the next crop to be grown in the area. (Alexander-DTT) W87-00199

EFFECTS OF SODIUM CHLORIDE ON GROWTH AND NITROGEN FIXATION IN CASUARINA OBESA MIQ.,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.

P. Reddell, R.C. Foster, and G.D. Bowen. New Phytologist, Vol. 102, No. 3, p 397-408, March 1986. 3 fig, 3 tab, 17 ref.

Descriptors: *Sodium chloride, *Nitrogen fixation, *Casuarinaceae, Electron microscopy, Infection, Salt tolerance, Symbiosis, Australia.

Salt tolerance, Symbiosis, Australia.

In the field (Western Australia), nodulation of Casuarina obesa Miq. was found at sites with salinity levels up to 28 mg Cl(-/y of soil. A subsequent glasshouse study examined effects of step-wise additions of NaCl on plant growth and symbiotic Nixation in C. obesa seedlings nodulated by Frankis from two sources. Irrespective of the Frankis source, plant growth declined above 0.15 mg NaCl/g soil, but some growth occurred at 15 mg NaCl/g soil. N fixation also decreased above 0.15 mg NaCl/g soil, with total nodule weight being reduced at NaCl levels greater than 0.15 mg NaCl/g soil, goil for the frankis sources. However, increasing NaCl markedly reduced the N fixed per mg nodule weight for only one Frankis source, N fixed per mg nodule was reduced by 60% at 1.5 mg NaCl/g soil and inhibited at 15 mg NaCl/g soil soil. Electron micrographs of the 'effective' nodules from the high-salt treatment showed Frankis infected cells to have low (putative) Cl(-) levels when compared with adjacent uninfected cells. At levels of 1.5 and 15 mg NaCl/g soil, both Na(-) and Cl(-) accumulated in shoots. Electron micrographs of shoots from the 15 mg NaCl/g soil treatment showed Cl(-) to be concentrated in the intercellular spaces and in the hypodermal cells. The success of plantings of salt-tolerant Casuarina-ceae such as C. obesa requires the selection of

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highly salt-tolerant plant and Frankia genotypes. (Author's abstract) W87-00214

EFFECT OF WATER DEFICIT ON YIELD AND PROTEIN CONTENT IN PEARL MILLET

GRAINS, International Crops Research Inst. for the Semi-Arid Tropics, Patancheru (India). V. Mahalakshmi, V. Subramanian, F. R. Bidinger, and R. Jambunathan. Joursal of Science of Food and Agriculture, Vol. 36, p 1237-1242, December 1985. 2 tab, 19 ref.

Descriptors: "Water deficit, "Pearl millet, "Pro-tein, "Grain, "Plant growth, "Crop yield, "Mois-ture stress, "Carbohydrate accumulation, Plant physiology, Panicle development, Genotype.

Seventy-two pearl millet genotypes were water stressed at panicle development and grain filling stages. Neither grain yields, yield components, protein percent nor total protein per unit area were affected by water deficit during panicle development, but protein content per grain was increased. When plants were water stressed during grain filling, grain yield, grains per unit area, and 1,000 grain weight were reduced, but grain protein percentage increased. Total protein per unit area was reduced, primarily due to lower grain yield. The protein content per grain was unaffected by stress, suggesting that the apparent increase in protein percentage is due to reduced carbohydrate accumulation under stress. (Author's abstract) W87-00230

RECOVERY OF ADENINE-NUCLEOTIDE POOLS IN TERRESTRIAL BLUE-GREEN ALGAE AFTER PROLONGED DROUGHT PE-RIODS.

strons, Konstanz Univ. (Germany, F.R.). Lehrstuhl fuer Physiologie und Biochimie der Pflanzen. S. Scherer, T.-W. Chen, and P. Boger. Oecologia OECOBX, Vol. 68, No. 4, p 585-588, March 1986. 4 fig, 2 tab, 31 ref.

Descriptors: *Drought, *Algae, *Cyanophyta, *Rewetting, *Adenosine triphosphate, *Adenosine diphosphate, *Adenosine monophosphate, *Cxidative phosphorylation, Chlorophyll, Algal mats, Plant physiology, Water stress.

The response to rewetting after 2 wk to 5 yr of drought was studied in Nostoc commune and N. flagelliforme, originally collected in the field, and rewetted on Parafilm substrates. In N. flagelliforme the energy charge (EC), about 0.18 in the dry condition, increase rapidly (EC = 0.7 after 1 hr) and more slowly in a second phase (0.8 after 6 hr). The content of AXP (=ATP+ADP+AMP) apparently increases due to de novo synthesis of adenine nucleotides. ATP build-up after a drought period probably is provided by oxidative phosphorylation. The observed increase is the same whether the drought period extends 6 mo or 5 yr. Dry samples of N. commune exhibit very low ATP, but high ADP contents. Within 6 hr after rewetting, the final level of extractable ATP (60-100 nanomole/mg chlorophyll) is recovered. (Rochester-PTT)

MASS SELECTION FOR SALT RESISTANCE IN RHODES GRASS (CHLORIS GAYANA), IN RHODES GRASS (CRILDRIS GALANA), Tel-Aviv Univ. (Israel). Dept. of Botany. E. Malkin, and Y. Waisel. Physiologia Plantarum PHPLAI, Vol. 66, No. 3, p 443-446, March 1986. 2 fig, 4 tab, 15 ref.

Descriptors: *Rhodes grass, *Water stress, *Salt tolerance, *Protein synthesis, *Seed production, *Multiple clipping, *Plant growth, Plant physiology, Selection, Forages.

High salt stresses were exerted upon seedlings of the common variety of Rhodes grass (Chloris gayana Kunth, to select a salt-resistant strain and to escertain the characteristics that differentiate between the original parent population and the currently selected one. Five generations of seed-

lings were grown on sand culture and irrigated with NaCl solutions up to 0.7 M. The most successful survivors of each generation were selected and grown to maturation and seed production. Plants of the F sub 5 selected population showed a marked improvement in their survival and regeneration capabilities after harvesting. Some effects of selection were found in seed germination and in water use. No apparent differences between the parent and the F sub 5 populations were found in growth of unclipped plants, ion content, or protein synthesis. The data presented indicate that the capability to survive through salt stresses can be raised in Rhodes grass by mass selection. Prudamentally this is achieved by improving the regeneration capacity of plants after multiple clippings. (Author's abstract)

RESPONSE OF SORGHUM TO A WATER GRADIENT AND POTASSIUM VARIABLE, Nevada Univ., Reno. Dept. of Plant, Soil and D. A. Devitt, L. H. Stolzy, W. A. Jury, and G.

Lopatynski. Plant and Soil PLSOA2, Vol. 93, No. 1, p 67-77, 1986. 3 fig, 1 tab, 23 ref.

Descriptors: *Water stress, *Water deficit, *Sorghum, *Potassium, *Soil Water gradient, *Irrigation, *Crop yield, Plant physiology, Lysimeters, Mathematical analysis, Water potentials, Diffusive

A modified line-source sprinkler system was employed in a field study to investigate the hydrologic balance of a sorghum crop subjected to water deficit stress. Sixteen lysimiters packed with a Greenfield sandy loam and planted to sorghum (Sorghum bicolor) were placed under a moisture gradient irrigation system. Four levels of K were used (0, 100, 200, or 300 kg/ha). When the leaching fraction was set at 0.15 near the source, the predicted leaching fraction would go to zero at 10 m from the source. Although yield was related to evapotranspiration, a better fit to the yield data was obtained when a parameter that included the availability and deficit term was used. The relavoinship described an exponential fit. This parameters was used. the state of the s

CHANGES INCLUDE BY SALINITY TO THE ANATOMY AND MORPHOLOGY, OF EX-CISED PEA ROOTS IN CULTURE, CISED FEA ROUTS IN CULTURE, Hebrew Univ., Jerusalem (Israel). Dept. of Botany. M. Solomon, E. Gedalovich, A.M. Mayer, and A. Poljakoff-Mayber. Annals of Botany ANBOA4, Vol. 57, No. 6, p 811-818, June 1986. 3 fig, 4 tab, 22 ref.

Descriptors: *Salinity, *Salt tolerance, *Anatomy, *Morphology, *Pea roots, Plant physiology, Tissue culture, Plant growth, Cellular differentia-

Excised pea roots were grown in culture in the absence or presence of NaCl. Salinity induced anatomical and morphological changes in the roots, some of which could be observed after only 24 hr in culture. Roots became constricted just above the apex, the region above the constriction thickened and the root tip curved through 90 deg. Cellular differentiation began nearer the apex, cortical and epidermal cells shortened and mitotic activity in the pericycle increased as a result of exposure to salinity. Some of the changes resemble those induced by ethylene, but ethylene probably was not the cause of the response to salinity. Root cultures seem to be a suitable model for studying the effect of salinity on plant roots. (Author's abstract) W87-00262

COMPARATIVE DROUGHT RESISTANCE OF LANDRACES OF SORGHUM AND MILLET FROM DRY AND HUMID REGIONS, Volcani Inst. of Agricultural Research, Bet-Dagan

(Israel). A. Blum, and C.Y. Sullivan. Annals of Botany ANBOA4, Vol. 57, No. 6, 835-846, June 1986. 2 fig, 3 tab, 33 ref.

Descriptors: *Sorghum, *Millet, *Drought resistance, *Land races, *Arid climates, *Humid climates, India, Mali, Hydroponics, Plant growth, Plant physiology, Water stress, Photosynthesis, Transpiration, Carbon exchange rate, Evolution,

Genotypes.

Twenty land-races were chosen of millet and sorghum that evolved along geographical gradients of rainfall, seven millets from India, six sorghums from Mali, and seven sorghums from the Sudan. Races were evaluated for their growth potential and plant water relations under hydroponics conditions in a growth chamber. A water stress treatment was imposed by adding polyethylene glycol-8000 to the nutrient solution, giving a solute water potential of -0.5 MPa, compared with a control solution at 0.03 MPa. Relatively less growth inhibition under stress was seen in races from dry regions than in races from humid regions. Of all the physiological variables measured (carbon exchange rate (CER), transpiration, transpiration ratio, leaf diffusive resistance, leaf water potential, and osmotic adjustment, only osmotic adjustment under stress was generally correlated with average rainfall at each race's origin, indicating greater osmotic adjustment in land-races from drier regions. Races with a greater capacity for osmotic adjustment were characterized by smaller plants with high rates of transpiration and low rates of leaf sense-cence under stress. The results for the measured variables showed a general trend for greater drought resistance in sorghum than in millet, indivariables showed a general trend for greater drought resistance in sorghum than in millet, indicating that the commonly served adaptation of the millets to dry environments may be due to other factors, such as drought escape or heat tolerance (Rochester-PTT) W87-00263

EFFECTS OF NACL STRESS ON PROLINE AND CATION ACCUMULATION IN SALT SENSITIVE AND TOLERANT TURFGRASSES, Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.

W. A. Torello, and L. A. Rice. Plant and Soil PLSOA2, Vol. 93, No. 2, p 241-247, 1986. 3 fig. 1 tab, 18 ref.

Descriptors: *Water stress, *Salt stress, *Salt tolerence, *Potassium accumulation, *Sodium accumulation, *Turf grasses, Proline accumulation, Alkali grass, Red fescue, Kentucky bluegrass, Cation accumulation, Plant physiology, Osmoregulation.

Concentrations of proline, sodium, and potassium in shoot tissues of five turfgrass species were measured following exposure to 170 mM NaCl salinity stress. Salt-tolerant 'Fults' alkaligrass and 'Dawson' red fescue restricted the accumulation of Na-ions to significantly low levels compared to the salt-sensitive Kentucky bluegrasses ('Adelphi' and 'Ram I') and 'Jamestown' red fescue. Accumulation of proline began in all species within 24 hr of initiation of salt stress, but a more rapid rate and higher overall concentration for 'Fults' alkaligrass. Proline levels were variable and too low in relation to sodium accumulations to have any significant osmoregulatory role in salt tolerance among all cultivars tested, with the possible exception of alkaligrass. (Author's abstract)

DROUGHT AND DIEBACK OF RURAL EUCA-

Australian National Univ., Canberra. Research School of Biological Sciences. L. Landsberg.

Australian Journal of Ecology, Vol. 10, No. 2, p 87-90, June 1985. 1 fig, 2 tab, 13 ref.

Descriptors: *Drought, Moisture deficiency, *Plant growth, Eucalypts, Australia, Dieback, Canopy conditions, Plant water potential.

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The possibility that drought causes dieback of eu-calypts in rural Australia was investigated. Water potential and canopy condition in dieback and healthy rural Eucalyptus blakelyi and E. mellioneatiny rural Eucalyptus biaketyi and E. mellio-dora trees were compared during and after an extreme drought. All the trees were drought af-fected, but the extent was independent of the con-dition of their canopies at the beginning of the study. (Author's abstract) W87-00352

VEGETATION AND FLORA ASSOCIATED WITH LOCALIZED SNOW ACCUMULATION AT MOUNT FIELD WEST, TASMANIA, Tasmania Univ., Hobart (Australia). Dept. of

Botany. N. Gibson, and J. B. Kirkpatrick. Australian Journal of Ecology, Vol. 10, No. 2, p 91-99, June 1985. 6 fig, 3 tab, 23 ref, append.

Descriptors: *Snow, *Precipitation, *Vegetation, Plant growth, Mount Field West, Tasmania, Soil drainage, Climate.

The vegetation associated with a snow patch at Mt. Field in Tasmania is described and mapped. Seven distinct vegetation types were related directly to topography and hence to the patterns of snow accumulation, snow melt and soil drainage. The fieldmark found where snow lies longest is unusual for Tasmania and may be the product of past climatic events and a peculiar parent material. At the generic level there exists a high similarity with thee snow patch flora of the Australian Alps. (Author's abstract)

STRUCTURE AND FUNCTIONING OF WATER-STORING AGRICULTURAL POLYA-

CRYLAMIDES, Liverpool Univ. (England). Dept. of Biology, For primary bibliographic entry see Field 3F. W87-00399

WATER STRESS AND SEASONAL EFFECTS ON RUBBER QUALITY IN IRRIGATED GUA-YULE,

Firestone Tire and Rubber Co., Akron, OH. Central Research Labs.
W. W. Schloman, Jr., D. J. Garrot, Jr., and D. T.

Journal of Agricultural and Food Chemistry JAFCAU, Vol. 34, No. 4, p 683-685, July/August 1986. 2 tab, 27 ref. NAVAIR Contract N00019-82-C-0486.

Descriptors: "Rubber, "Guayule, "Irrigation effects, "Irrigation requirements, "Water stress, Seasonal variation, Plant physiology, Gels, Chromatography, Temperature effects, Irrigation.

Rubber quality in a single guayule line from irrigated plots was sampled over a seven-month period. Three irrigation regimes were essablished according to the crop water stress index (CWSI) and plots were irrigated when their respective CWSI values exceeded wet, medium and dry. Rubber molecular weights were analyzed by gel permeation chromatography. Molecular weight for all three irrigation regimes increased during the quiescent period (January-March) and decreased for all regimes when active growth resumed (March-April). By May, molecular weight had increased above March values. Between irrigation regimes, significant differences in molecular weight were observed in January and June with the dry plots yielding the highest weight in both instances. (Michael-PTT)

CONTROL OF NA(+) AND K(+) TRANSPORT IN SPERGULARIA MARINA: I. TRANSPIRA-TION EFFECTS

Illinois Univ. at Urbana-Champaign. Dept. of Plant

Biology.

J. M. Cheesemen, and L. K. Wickens.

Physiologia Plantarum PHPLAI, Vol. 67, No. 1, p
1-6, May 1986. 6 fig, 3 tab, 21 ref. NSF Grant

PCM 83-04417.

Descriptors: *Sodium, *Potassium, *Translocation *Transpiration, *Spergularia marina, *Ion trans-port, *Seawater, *Salinity, Light, Leaves, Correla-tion, Isotope studies, Plant growth, Plant physiolo-

The involvement of transpiration in control of Na(+) and K(+) uptake in S. marina (L.) Griseb. was considered because of its potential to account for much or all of the transport of ions, and particularly of Na(+), during growth at moderate salinity (0.2 x sea water). Transpiration was constant with time through most of the light period, quickly dropping to 6% of the daytime rate at night. 22Na(+) uptake showed much less day/night variation, and relative transport to the shoot was constant. Transpiration was correlated linearly with leaf weight. Under constant, daytime conditions, with linear effects of time and plant size removed, total transport of 22Na(+) to the shoot (per plant) was not correlated with leaf weight. A similar result was found when transport was expressed per gram of root, and when partitioning of total label to the shoot was considered. The correlation between leaf weight and Na(+)/K(+) enrichment factor (defined as the Na(+)/K(+) ratio in the leaves divided by that in the roots) also was not significant. Thus, analysis of control of Na(+) and K(+) uptake and transport in this experimental system need not consider the effects of transpiration. (See also W87-00354 thru W87-00555) (Au-tw87-00553)

CONTROL OF NA(+) AND K(+) TRANSPORT IN SPERGULARIA MARINA: IL EFFECTS OF PLANT SIZE, TISSUE ION CONTENTS AND ROOT-SHOOT RATIO AT MODERATE SALIN-

ITY, Illinois Univ. at Urbana-Champaign. Dept. of Plant

Biology.

J. M. Cheeseman, and L. K. Wickens.

Physiologia Plantarum PHPLAI, Vol. 67, No. 1, p

7-14, May 1986. 3 fig, 5 tab, 21 ref. NSF Grant

PCM 83-04417.

Descriptors: *Sodium, *Potassium, *Translocation, *Transpiration, *Spergularia marina, *Jon transport, *Seawater, *Sainity, Light, Leaves, Correlation, Root-shoot ratios, Multiple regression analysis, Allosteric regulation hypothesis, Isotope studies, Plant growth, Plant physiology.

sis, Allosteric regulation hypothesis, Isotope studies, Plant growth, Plant physiology.

Uptake of Na(+) and K(+) in vegetative S. marina (L.) Griseb. was analyzed in plants grown in 0.2 x sea water solution culture. The results were broadly similar for 22Na(+) and 42K(+). Total uptake was significantly and negatively correlated with rootshoot ratio (RSR) and root weight, and positively with root K(+) content (K sub r). These three variables were mutually correlated, and this was reflected in multiple analyses as a reduction or loss of significance of one or more of the measures. Transport to the shoot was very highly correlated with total uptake, resulting in nearly identical regression results for both isotopes. In multiple regression analyses of root data alone, accumulation was related only to root contents, but in a manner inconsistent with the allosteric regulation hypothesis, the most significant correlation being positive for K sub r. The results were nearly identical for the two isotopes. The results were nearly identical for the two isotopes. The results were not consistent with a single factor regulatory system involving only initial root plasmalemma ion influx. The observed Na(+)-K(+) and root-shoot balances seem to require at least involvement of symplast-to-medium and symplast-to-xylem transport steps. A physiological working hypothesis is presented, in which the positive correlation of uptake and root contents is balanced by a negative feedback signal deriving from plant size and by the diluting effects of growth. The negative interaction of RSR is postulated to manifest the integrating system required to deliver ions to the shoot at the required rates. (See also W87-00553 thru W87-00554

CONTROL OF NA(+) AND K(+) TRANSPORT IN SPERGULARIA MARINA: III. RELATION-SHIP BETWEEN ION UPTAKE AND GROWTH AT MODERATE SALINITY,

Illinois Univ. at Urbana-Champaign. Dept. of Plant man, and L. K. Wicker

Physiologia Plantarum PHPLAI, Vol. 67, No. 1, p 15-22, May 1986. 5 fig, 4 tab, 14 ref. NSF Grant PCM 83-04417.

Descriptora: *Sodium, *Potassium, *Translocation, *Transpiration, *Spergularia marina, *Ion transport, *Seawater, *Salinity, Light, Leaves, Correlation, Ion uptake, Isotope studies, Plant growth, Plant physiology.

Plant physiology.

Growth analysis techniques were employed to compare relative growth rates (RGR) and relative accumulation rates (RAR) for Na+ an(d) K(+) in S marina (L.) Griseb. grown in 0.2 x sea water medium. Under constant growth conditions, a high correlation between RGR and RAR indicated that growth and accumulation of both ions were well balanced, resulting in Na(+) and K(+) concentrations within the plants that were stable after adjustment to the saline medium. The analysis confirmed the existence of Na(+)-related growth stimulation in S marina and an associated increase in the efficiency of K(+) utilization for growth. RGR and RAR remained similar through experimental discontinuities in growth conditions, suggesting that growth and ion accumulation were co-regulated rather than simply correlated. The growth analysis data were transformed to give net uptake rates for Na(+) and K(+), and the results were compared to those of isotope studies under similar growth conditions. In roots, the rates estimated by the two techniques differed substantially; net uptake rates reflected primarily growth, whereas isotope studies indicated a substantial ion exchange between mature cells and the growth medium. The rates of transport of either Na(+) to K(+) to the shoot were very similar using the two estimation techniques. Rates measured with isotopes resulted from studies lasting only a few hours, suggesting a very rapid turnover of upwardly-mobile Na(+) and K(+) pools in the roots. (See also W87-00553, thru W87-00555

SALT BALANCE OF LEAVES OF THE MAN-GROVE AVICENNIA MARINA, Tel-Aviv Univ. (Israel). Dept. of Botany. Y. Waisel, A. Eschel, and M. Agami. Physiologia Plantarum PHPLAI, Vol. 67, No. 1, p 67-72, May 1986. 3 fig. 1 tab, 30 ref.

Descriptors: *Salt balance, *Avicennia marina, *Salt rejection, Mangrove, Transpiration, Xylem sap concentration, Salt content, Recretion, Plant

Transpiration rates, xylem sap concentration, leaf salt content, recretion rates, and rates of salt retranslocation out of the leaves of the salt-recreting mangrove A marina (Forsak.) Vierh. were monitored continuously during 3-day periods and the salt fluxes in and out of the leaves were calculated. Salt filtration by the roots was by far the most important salt-rejecting mechanism, preventing some 80% of the salt that is carried toward the root surface by the transpiration stream from enering the shoot. Out of the remaining quantity of salts that enter the root xylem and reach the leaves, only 40% is removed by the salt-recreting glands. (Author's abstract)

EFFECTS OF DIFFERENT SOIL WATER PO-TENTIALS, TEMPERATURE AND SALINITY ON GERMINATION OF SEEDS OF THE DESERT SHRUB ZYGOPHYLLUM DUMO-

Tel-Aviv Univ. (Israel). Dept. of Biology. M. Agami. Physiologia Plantarum PHPLAI, Vol. 67, No. 2, p 305-309, June 1986. 5 fig, 28 ref.

Descriptors: *Zygophyllum dumosum, *Tempera-ture, *Soil water potential, *Germination, *Seeds, *Desert plants, *Salinity, Israel, Shrub, Field ca-pacity, Plant physiology.

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Seeds of Z dumosum Boiss, a common shrub of the Israeli desert, had to be exposed to constant field capacity conditions (-0.0316 MPa) for mini-mum of 2 days before germination could start. Maximal germination under such conditions oc-curred after 4 days or more. Under simulated mum of 2 days before germination could start. Maximal germination under such conditions occurred after 4 days or more. Under simulated conditions of gradual dehydration of the soil, seeds were inhibited either at low soil water potentials (-0.10 to -10.00 MPa) or at high ones (-0.002 to -0.0398 MPa). Germination of Z dumosum was independent of temperature in the range of 10-25 C, but strongly inhibited at 30 and 35 C. At 20 C germination was inhibited by salinity of the medium, but still occurred (0.5%) even at a concentration of 0.5 M NaCl. (Author's abstract) W87-00557

GROWTH AND SOLUTE ACCUMULATION IN GROWTH AND SOLUTE ACCUMULATION IN S-WEEK-OLD SEEDLINGS OF AGROPYRON ELONGATUM STRESSED WITH SODIUM AND POTASSIUM SALI'S, Agricultural Research Service, Riverside, CA. Salimity Lab. R. Weimberg.

Physiologia Plantarum PHPLAI, Vol. 67, No. 2, p 129-135, June 1986. 1 fig, 2 tab, 42 ref.

Descriptors: *Agropyron elongatum, *Salinity, *Piant growth, *Potassium, *Sodium, *Osmotic pressure, *Seedlings, *Growth rates, Monovalent cations, Hydroponics, Plant physiology.

Agropyron elongatum (Host. (Beauv.)) cultivar Arizona Glendale was grown in liquid medium salinized with either NaCl, KCl, or a 50:50 mixture of these salts at osmotic potentials ranging from 0 to -1.6 MPa. The amount of growth in 21 days was measured and shoot extracts were obtained at this time. Growth inhibition was roughly proportional to the osmotic potential of the growth medium and was independent of the ionic composition of the salinizing salts. Total monovalent cation concentrations (K(+) and Na(+)) and the ratios of these two cations in the leaves were mainly a function of the ionic composition of salt in growth media and, to a lesser degree, of osmotic potentials. Although total monovalent cation concentrations in plants grown under either 100% NaCl or a 50:50 mixture of NaCl and KCl were equal, the K(+)/Na(+) ratios shifted from 1:2 in plants grown in 100% NaCl to 3.1 in plants grown subjected to the 50:50 mixture. In the range of osmotic potentials from -0.2 to -1.2 MPa, the chloride:cation ratio was 1:2: at -1.6 MPa the ratio became 3:4. Proline started accumulating in the leaves when the tissue concentration of total monovalent cations exceeded 200 micromole/g fresh weight. Above this threshold value of total monovalent cations, the proline contration of total monovasient canons executed Avmicromole/g fresh weight. Above this threshold value of total monovalent cations, the proline concentration of leaves was 6% of the amount of total monovalent cation that exceeded 200 micromol/g fresh weight. (Rochester-PTT) W87-00558

LIMITATIONS DUE TO WATER STRESS ON LEAF NET PHOTOSYNTHESIS OF QUERCUS COCCIFERA IN THE PORTUGUESE EVER-GREEN SCRUB,

GREEN SCHUB,
San Diego State Univ., CA. Systems Ecology Re-search Group.
J. D. Tenhunen, O. L. Lange, P. C. Harley, W.
Beyachiag, and A. Meyer.
Oecologia OECOBX, Vol. 67, No. 1, p 23-30,
August 1985. 9 fig, 24 ref.

Descriptors: "Quercus coccifera, "Evergreen scrub, "Water stress, "Photosynthesis, "Carbon dioxide, "Stomata, "Leaves, Shrubs, Season, Mesophyll, Plant physiology, Drought, Portugal, Temperature, Light, Transpiration, Leaf water potential, Sclerophyll ahrub.

Gas exchange characteristics in leaves of the scler-ophyll shrub Quercus coccifera were studied in the natural habitat in Portugal during spring and summer. Compared to other sclerophyll species growing at the same site, photosynthesis in leaves of Q. coccifera was less affected by water stress. Moderate water stress after 6 weeks of drought led to large decreases in stomatal conductance but no change in mesophyll photosynthetic capacity com-pared to late spring. In contrast to previous results

with Q. suber, restriction of CO2 supply due to stomatal closure reduced net CO2 uptake at midday and in the afternoon during midsummer. During the late stages of drought in September, severe water stress led to a reduction in mesophyll photosynthetic capacity and further reduction in leaf conductance. The observed decrease in mesophyll photosynthetic capacity was correlated with a decrease in the daily minimum leaf water potential to greater negative values than -30 bar. At this time, CO2-saturated photosynthetic rates decreased as much as 50% over the course of a day when measured in constant saturating light at 32 C leaf temperature and a water vapor mole fraction difference between leaf and air of 30 millibar/bar. (Author's abstract)

CANOPY DYNAMICS AND CARBON GAIN IN RESPONSE TO SOIL WATER AVAILABILITY IN ENCELIA FRUTESCENS GRAY, A DROUGHT-DECIDUOUS SHRUB,

Utah Univ., Salt Lake City. Dept. of Biology. J. Comstock, and J. Ehleringer. Oecologia OECOBX, Vol. 68. No. 2, p 271-278, January 1986. 6 fig, 34 ref. NSF Grant DEB 81-13136.

Descriptors: *Encelia frutescens, *Leaves, *Drought, *Deciduous shrubs, *Photosynthesis, Mohave Desert, Sonoran Desert, Phoenix, Arizona, Plant growth, Plant physiology.

na, Plant growth, Plant physiology.

The production and longevity of leaves of E. frutescens Gray, a subshrub of the Mohave and Sonoran Deserts, were observed during the summer and fall of 1983 in an experimental field garden in Phoenix, Arizona. Maximum leaf life spans during a summer activity period were between 3 and 4 months, with the great majority of leaves living between 1 and 3 months. Leaf production occurred synchronously in well-defined cohorts triggered by precipitation events. Extensive leaf turnover occurred during summer even though plants remained in continuous leaf. Turnover was most pronounced when precipitation triggered the production of new leaf cohorts. Five weeks were required for plants to reach maximum canopy development when renewed soil water availability followed a long drought. Photosynthetic capacity per unit leaf area recovered much sooner than total leaf area, and submaximal leaf area development was the major factor limiting whole-plant carbon gain during a leaf-flushing period lasting several weeks. As the soil began to dry out, physiological capacity declined more rapidly than leaf area and became the primary limiting factor to whole-plant carbon gain. (Author's abstract)

W87-00577

RELATIONSHIP OF MYCORRHIZAL GROWTH ENHANCEMENT AND PLANT GROWTH WITH SOIL WATER AND TEX-TURE

Agricultural Research Service, Albany, CA. S. Dakessian, M. S. Brown, and G. J.

Bethlenfalvay.
Plant and Soil PLSOA2, Vol. 94, No. 3, p 439-443, 1986. 2 fig, 1 tab, 24 ref.

Descriptors: *Mycorrhizae, *Plant growth, *Soil water, *Soil texture, *Soybeans, *Phosphorus, *Nutrient availability, Symbiosis, Endophytes,

Soybean plants were grown in pots with or with-out vesicular-arbuscular mycorrhizal (VAM) fungi in three soils of low plant-available P content, different texture, and different water-holding cadifferent texture, and different water-nothing capacities. Mineral nutrients other than P were provided in a complete nutrient solution. The biomass of non-VAM plants was positively, and fungal colonization negatively, correlated with increasingly coarse soil texture. There was no positive correlation of soil P with host or endophyte correlation of soil P with host or endophyte that the property of the property was correlated. correlation or soil r with nost or endophyte growth. Plant growth enhancement was correlated positively with soil water content at -1.5 MPa. These observations suggest that soil water status and the mycorrhizal condition interact in influencing plant growth. (Author's abstract)

W87-00669

SALT TOLERANCE OF EGGPLANT, Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water. B. Heuer, A. Meiri, and J. Shalevet. Plant and Soil PLSOA2, Vol. 95, No. 1, p 9-13, 1986. 1 fig, 3 tab, 5 ref.

Descriptors: *Eggplant, *Salt tolerance, *Saline soils, *Drip irrigation, *Conductivity, Crop yield, Irrigation Frequency.

The salt tolerance of eggplant and its response to soil salinity were determined over a 2-yr period In e sait tolerance of eggphant and its response to soil salinity were determined over a 2-yr period during which small field plots were irrigated by drip irrigation; irrigation frequency was also a variable. The salt tolerance function determined was Y sub r = 100 - 6.9 (EC sub e - 1.1), in which Y sub r = relative yield and EC sub e = the mean electrical conductivity of the soil saturation extract. The 2 of the respression was 0.87, and the threshold er resauve yield and EC sub e = the mean electrical conductivity of the soil saturation extract. The r2 of the regression was 0.87, and the threshold value EC sub e = 1.1 dS/sq m was the lowest salinity of the experiment. Yield was reduced at the rate of 6.9% per unit increase in soil salinity, which amounted to 1.37 and 0.75 kg/sq m/dS/m for 1979 and 1980, respectively. A two-fold difference in maximum yield between the two years, 19.8 kg/sq m in 1979 and 10.9 kg/sq m in 1980, was due to the difference in row spacing (1 m vs. 2 m) and not the difference in planting density (1.5 versus 2 plants per sq m). Neither planting density nor soil texture appeared to affect the tolerance of eggplant to soil salinity. Using water with the same electrical conductivity, higher salt accumulation was observed under high-frequency drip irrigation. (Rochester-PTT)

SNAILS AND AQUATIC VEGETATION IN GEZIRA IRRIGATION CANALS, Institute for Tropical Medicine, Khartoum (Sudan). Schistosomiasis Research Project. For primary bibliographic entry see Field 5G.

MECHANISM OF SALT TOLERANCE IN WILD RICE (ORYZA COARCTATA ROXB), Central Soil Salinity Research Inst., Karnal (India). For primary bibliographic entry see Field 3C. W87-00722

SPECIFIC ION TOXICITY, California Univ., Davis. Dept. of Land, Air and Water Resources. SALT SENSITIVITY IN WHEAT: A CASE FOR For primary bibliographic entry see Field 3C. W87-00724

VESICULAR-ARBUSCULAR MYCORRHIZAL (GLOMUS FASCICULATUM) INFLUENCE ON SOYBEAN DROUGHT TOLERANCE IN HIGH PHOSPHORUS SOIL,
Oregon State Univ., Corvallis. Dept. of Microbi-

ology. M. D. Busse, and J. R. Ellis. Canadian Journal of Botany CJBOAW, Vol. 63, No. 12, p 2290-2294, December 1985. 2 fig, 4 tab,

Descriptors: *Mycorrhizal fungi, *Glomus fasciculatum, *Soybeans, *Drought resistance, Crop production, Growth, Yield, Fungi.

Vesicular-arbuscular mycorrhizal fungi (VAM) may enhance growth of nonirrigated soybean (Glycine max (L.) Merr.) by improving host drought tolerance. This study determined growth and yield response of drought stressed soybean in the greenhouse to infection by the mycorrhizal endophyte Glomus fasciculatum. To create stress treatments, water was withheld for nine days during the pod elongation stage, and half of the plants were harvested immediately after the stress period and half at physiological seed maturity. Plants harvested immediately after stress (51 days after emergence) had a significant reduction in

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mycorrhizal infection and soybean nodulation. The root-to-shoot ratio of stressed plants inoculated with VAM decreased 24% compared with noninoculated plants, indicating enhanced host drought tolerance by G. fasciculatum. Total seed weight of stressed plants increased 10% when infected with VAM as a result of reduced pod abortion. Significant G. fasciculatum x drought stress interactions were found for total seed weight, pod number, seed number, and root-to-shoot ratio, showing that G. fasciculatum has a more positive effect on drought-stressed compared with control plants. The results of this experiment show potential benefits of VAM colonization in soybean in arid and semiarid regions. (Author's abstract)

EFFECT OF SUGAR MILL EFFLUENT ON ENZYME ACTIVITIES OF RICE SEEDLINGS, Jawaharlal Nehru Univ., New Delhi (India). School of Life Sciences. For primary bibliographic entry see Field 5C. W87-00791

ECOLOGICAL STUDIES ON FOUR RAINFOR-ESTS IN KARNATAKA, INDIA: I. ENVIRON-MENT, STRUCTURE, FLORISTICS AND BIO-MASS, Sandal Research Centre, Bangalore (India).

Sandai Research Cents, Sangais Constant Sandai Research Cents, S. N. Rai, and J. Proctor.
Journal of Ecology JECOAB, Vol. 74, No. 2, p 439-454, June 1986. 7 fig, 10 tab, 27 ref.

Descriptors: *India, *Ecology, *Rainforests, *Biomass, *Karnataka, *Ecosystems, Environment, Ecological distribution, Species diversity, Rainfall, Precipitation, Forests, Trees, Growth, Coniferous

The environment, structure, and floristics of four evergreen rainforest sites were studied at 575-800 m altitude in Karnataka, southern India. The mean annual rainfall on the four sites ranges from 5310 to 7670 mm. Most of the rainfall occurs from June to September, and there is an intense dry period from December to April. All the sites occur on oxisols overlying hornblendic rocks. The forests at three of the sites are species-rich with an important contribution from the Dipterocarpaceae. However, one site is unusual, with an almost monospecific dominance by Poeciloneuron indicum (Guttiferae). The total above-ground tree biomass was 420-649 tons per hectare. Girth increment data over 35 years were available for one site, and these were used with biomass estimates to calculate the approximate mean annual increase of above-ground and root biomass in the four sites. These were 6.4-11.1 tons per hectare for above-ground material and 0.2-0.4 tons per hectare for roots. For small trees and herbs, biomass was estimated by destructive sampling in one plot. The combined above-ground biomass of these fractions was 7.2 tons per hectare. (Author's abstract)

EFFECT OF DROUGHT DURING DIFFERENT STAGES IN THE LIFE-CYCLE ON THE GROWTH AND BIOMASS ALLOCATION OF TWO AIRA SPECIES, Vrije Univ., Amsterdam (Netherlands). Biological

N. A. M. G. Rozijn, and D. C. Van Der Werf. Journal of Ecology JECOAB, Vol. 74, No. 2, p 507-523, June 1986. 4 fig, 16 tab, 43 ref, append.

Descriptors: *Drought, *Life cycles, *Growth, *Biomass, *Phenology, *Grasses, Dunes, Life history studies, Soil water, Plant growth, Water delicit, Drought resistance.

Drought treatment in the vegetative phase had no effect on growth in the reproductive phase in either Aira caryophyllea or A. praecox, both winter annual dune grasses. In the reproductive phase, A. praecox grew exponentially, while A. caryophyllea did not grow. The biomass allocation showed greater differences between the species than between the treatments, especially in the reproductive phase. The proportion of biomass allo-

cated to reproductive organs was affected by the drought treatments. The production of caryopaes was reduced by drought if it occurred in the vegetative as well as in the reproductive phase. In contrast to A. caryophyllea, A. praecox showed both somatic and reproductive growth after inflorescence emergence. A. caryophyllea seems better adapted to reproduction in a habitat with a restricted growing season, while the continued vegetative growth in the reproductive phase of A. praecox increases its survival during drought. Its continued vegetative growth may lead to a higher reproductive yield. The two species have different mechanisms for maintaining their existence in the same habitat. While A. caryophyllea is mainly adapted to a growing season of which the duration is restricted by drought, A. praecox is better adapted to drought itself. For that reason, A. praecox can be expected to occur in drier sites in a dune habitat than A. caryophyllea. (Author's abstract) W87-00799

DIFFERENTIAL RESPONSE OF NONSELECTED AND NA2SO4-SELECTED CALLUS CULTURES OF BETA VULGARIS L. TO SALT STRESS

Calgary Univ. (Alberta). Dept. of Biology. For primary bibliographic entry see Field 3C. W87-00806

RESPONSES OF KENAF TO SALT STRESS: GERMINATION AND VEGETATIVE GROWTH California Univ., Davis. Dept. of Land, Air and

Water Resources.
For primary bibliographic entry see Field 3C.
W87-00807

GROWTH RESPONSE OF YELLOW-POPLAR (LIRIODENDRON TULIPIFERA L.) SEED-LINGS TO OZONE, SULFUR DIOXIDE, AND SIMULATED ACIDIC PRECIPITATION, ALONE AND IN COMBINATION, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Plant Pathology and Physiology. For primary bibliographic entry see Field 5C. W87-0808

INVESTIGATION INTO THE USE OF DEUTE-RIUM AS A TRACER FOR MEASURING TRANSPIRATION FROM EUCALYPTS, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 2D. W87-00819

2J. Erosion and Sedimentation

TIME DEPENDENT PROPERTIES OF COHE-SIVE SEDIMENT RELEVANT TO SEDIMEN-TATION MANAGEMENT; EUROPEAN EXPE-RIENCE. of Oceanographic Sciences, Taunton

W. R. Parker, and R. Kirby.

IN: Estuarie Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 573-589, 9 fig. 52 ref.

Descriptors: "Cohesive sediments, "Sediment control, "Europe, "Time dependent properties, Estuaries, Management planning, Sedimentation, Acoustical properties, Mechanical properties, Dredging, Monitoring, Spoil disposal, Spoil banks, Deposition, Density measurement, Time series analysis

Field observations show fine sediment suspensions often have a mobile, high-concentration layer adjacent to the sea bed. Stationary suspensions which have time-varying acoustic and mechnical properties develop from these layers. In these circumstances, conventional survey echosounders can not provide unambiguous information on sea bed altitude relevant to safe navigation and optimum dredging practices. In Europe, echosounding is being replaced by in situ density measurement as

the means to define navigable depth and to moni-tor or control dredging. Repeated in situ density surveys allow time series of mass deposition to be constructed, dredging schedules to be optimized, and productivity to be increased. Techniques may then be developed to trap sediment in designated sites where stationary pumping systems remove spoil automatically at an optimum density. (See also W87-00005) (Author's abstract) W87-000027

RESUSPENSION POTENTIAL OF DEPOSIT-ED COHESIVE SEDIMENT BEDS, Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering. For primary bibliographic entry see Field 2L. W87-00028

SEDIMENTATION ASSOCIATED WITH TIDAL BARRIERS IN CHINA'S ESTUARIES AND MEASURES FOR ITS REDUCTION, Nanjing Hydrological Research Inst. (China). For primary bibliographic entry see Field 2L. W87-00029

DESCRIPTIONS OF THE MORPHOLOGY AND SEDIMENTARY STRUCTURES OF THE RIVER MOUTH BAR IN THE CHANG JIANG

RIVER MOUTH BAR IN THE CHANG JIANG ESTUARY, East China Normal Univ., Shanghai. Inst. of Estua-rine and Coestal Research. For primary bibliographic entry see Field 2L. W87-00033

CIRCULATION OF THE CHANG JIANG ESTU-ARY AND ITS EFFECT ON THE TRANSPORT OF SUSPENDED SEDIMENT, East China Normal Univ., Shanghai. Inst. of Estua-rine and Coastal Research. For primary bibliographic entry see Field 2L. W87-00034

STUDY OF DIFFUSION OF UPPER-LAYER SUSPENDED SEDIMENTS IN DISCHARGES FROM THE CHANG JIANG ESTUARY INTO THE SEA, BASED ON SATELLITE IMAGERY, East China Normal Univ., Shanghai. Inst. of Estuarine and Coastal Research. For primary bibliographic entry see Field 2L. W87-00035

TECHNICAL BACKGROUND INFORMATION FOR THE ENVIRONMENTAL AND SAFETY REPORT, VOL. 5: THE 1977 CLINCH RIVER SEDIMENT SURVEY - DATA PRESENTA-

TION,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W87-00047

INTERPRETATION OF THE SEDIMENTOLO-GICAL BEHAVIOUR OF THE TOCANTINS-ARAGUAIA BASIN, Eletronorte/Hidroesb S.A., Rio de Janeiro

(Brazil).

(Brazil).

B. A. L. Bequio, W. C. Lou, M. A. Siciliano, and O. V. Silveira.

IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 141-151, 5 fig. 3 tab, 9 ref.

Descriptors: *Sedimentology, *Tocatins River, *Araguaia River, *River basins, Sediment dis-charge, Sediment load, Sediment-carrying capac-ity, Water resources development, River basin de-velopment, Brazil.

The Tocantins-Araguaia basin in the Amazon region has in recent years been of increasing interest as a potential resource for power generation, agricultural and industrial water supplies and navigation; this has resulted in a better understanding

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of the physical processes governing the system. From a sedimentological point of view which considers the basin as a dynamic system, the present study takes all the available data into account, although morphological and hydraulic data are still being collected. The analytically developed approach allows qualitative and quantitative interpretations and emphasizes some aspects of basin behavior which are important for solving practical river engineering problems. Observing the maximum annual discharges at the Tucurui Dam site on the Tocantins River, a certain tendency can be seen for higher peaks in recent years. If there is a relationship between the liquid and solid discharges (as is illustrated here), it can be concluded that the solid discharge is also increasing. Obviously this analysis is not a complete analysis, but for the time being it can be assumed that certain factors in the basin influence this trend; these include deforestation, forest devastation, intensive use of soils, the activities of man. At present the cottors in the osain influence this treat, these include deforestation, forest devastation, intensive
use of soils, the activities of man. At present the
Tocantins Aragusia basin still exhibits hydrodynamic equilibrium with regard to the sediment
regime. However, due to the lack of data any
conclusion must be considered carefully, since
government agencies have started to study the
region only recently. For a better understanding of
the solid transport processes in the Rivers Tocantins-Aragusia and the erosive process in the basin,
it will be necessary to undertake regular new measurement programs in order to estimate their temporal variation. Simultaneously, technical and legal
controls are indispensable to prevent indiscriminant deforestation, erroneous management and utilization of soils. A third aspect that should be targeted is the search for sampling methods and calculations of soild discharge more adequate for large
tropical rivers such as the Tocantins and Aragusia.
(See also W87-00086) (Lantz-PTT)
W87-00096

SOIL EROSION IN THE HUMID TROPICS WITH PARTICULAR REFERENCE TO AGRICULTURAL LAND DEVELOPMENT AND SOIL MANAGEMENT, International Inst. of Tropical Agriculture, Ibadan

For primary bibliographic entry see Field 4D. W87-00103

SEDIMENT AND NUTRIENT DISCHARGE THROUGH STREAMFLOW FROM TWO EX-PERIMENTAL WATERSHEDS IN MATURE OAK-BEECH FOREST ECOSYSTEMS NEAR

OAK-BEECH FOREST EUDSYSTEMS NEAR BTANBUL, TURKEY, Istanbul Univ. (Turkey). Faculty of Forestry. A. N. Balci, N. Ozyuvaci, and S. Ozhan. Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 31-47, June 15, 1986. 11 fig. 5 tab, 8 ref.

Descriptors: "Sediment discharge, "Nutrient discharge, "Streamflow, "Demonstration watersheds, "Forest watersheds, "Istanbul, "Turkey, Magnesium, Calcium, Bicarbonate, Chlorine, Potassium, Nitrogen, Phosphorus, Suspended sediments, Regression analysis.

Initial results concerning the seventeen months of the calibration phase of a paired watershed experiment (Watersheds I-IV) are summarized. The water discharge from watershed IV is usually higher during the rainy season than that from watershed I, but this trend reverses during the dry watershed I, but this trend reverses during the dry season. Annual suspended sediment loads are low, on the order of 60-80 kg/ha/yr. Mg, and particularly Ca and HCO3 concentrations vary inversely with the rate of streamflow. The average monthly on the order of 60-80 kg/ha/yr. Mg, and particu-larly Ca and HCO3 concentrations vary inversely with the rate of streamflow. The average monthly loss of nutrients has significant correlations with streamflow. Regression equations for these rela-tions are presented. Annual losses of Ca, Mg, Cl, HCO3 and Na are substantially higher than for K, N and P. The losses of N are 3-4 kg/ha/yr and those for P around 0.4 kg/ha/yr. (Author's abstract) W87-00153

CULVERT SLOPE AND SHAPE EFFECTS ON OUTLET SCOUR, For primary bibliographic entry see Field 8B. W87-00205

STATISTICAL ANALYSIS OF BANK EROSION AND CHANNEL MIGRATION IN WESTERN CANADA,

Wollongong Univ. (Australia). Dept. of Geogra-

phy.

G. C. Nanson, and E. J. Hickin.

Geological Society of America Bulletin BUGMA,
Vol. 97, No. 4, p 497-504, April 1986. 5 fig. 3 tab,
31 ref. National Science and Engineering Research
Council of Canada Grant A8376.

Descriptors: *Channel migration, *Alluvial channels, *Bank erosion, *Statistical analysis, *Hydraulic variables, *Sedimentological variables, *Gravelbed streams, Particle size, Hydraulic geometry, Vegetation, Canada, Meanders.

Mean lateral-migration rates for 18 meandering river channels in western Canada are explained statistically in terms of hydraulic and sedimentolo-gical variables. The volume of sediment eroded from the outer bank of a meander bend is shown to general variances. In evolume of sediment eroded from the outer bank of a meander bend is shown to be largely a function of river size and grain size of sediment at the base of the outer bank. These variables explain almost 70% of the volumetric migration rate for these relatively large, sand- and gravel-bed streams. It would appear that bank erosion and channel migration are essentially problems of sediment entrainment, which is dependent on total stream power and sediment size. Vegetation on the outer bank is seen to have little significant effect in controlling channel migration. Further refinements of the type of data used here should permit the development of an accurate predictive model of regional channel migration. It is most important to develop a precise relationship between bank resistance and the size of sediment at the base of the outer bank. (Author's abstract) W87-00227

INFLUENCE OF SUBTERRANEAN TERMITES ON THE HYDROLOGICAL CHARACTERIS-TICS OF A CHIHUAHUAN DESERT ECOSYS-

TEM, New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G. W87-00235

EXAMPLE OF A PEAT FLOW NEAR PRINCE RUPERT, BRITISH COLUMBIA, Thurber Consultants Ltd., Vancouver (British Co-

O. Hungr, and S. G. Evans.
Canadian Geotechnical Journal CGJOAH, Vol.
22, No.2, p 246-249, May 1985. 4 fig, 11 ref.

Descriptors: *Prince Rupert, *Peat bogs, *Bogs, *Peat flow, Mass wasting, Peat soils, British Columbia, Flow slide.

Peat flows, bog flows, or bog bursts consist of a rapid downhill movement of masses of saturated peat. Although this process has been documented from peatlands in other parts of the world, the slope movement described is the first to be reported from the Canadian peatlands. The peat flow took place on the east coast of Kaien Island, near Prince Rupert, British Columbia and was initiated by a slump in a peat spoil pile. It involved the sudden mobilization of a strip of in situ peat 210 m long and approximately 20 m wide. The peat was fibrous, rich in roots and had a moisture content of approximately 240%. The flow demonstrated the high potential mobility of natural peat covers and the role of undrained loading in effecting movement of slopes as low as 5 degrees. (Khumbatta-PTT) PTT) W87-00280

MEASUREMENT OF BOUNDARY SHEAR STRESS IN NON-UNIFORM OPEN CHANNEL FLOW, Halcrow (William) and Partners, London (Eng-For primary bibliographic entry see Field 2E. W87-00323

CONCEPTUAL FRAMEWORK FOR PREDICT-ING THE OCCURRENCE OF SEDIMENT FO

CUSING AND SEDIMENT REDISTRIBUTION IN SMALL LAKES,
Freshwater Biological Association, Ambleside

Freshwater (England). J. Hilton

Limnology and Oceanography LIOCAH, Vol. 30, No. 6, p 1131-1143, November 1985. 2 fig, 2 tab, 43

Descriptors: *Lakes, *Sediments, Sediment focusing, Sediment redistribution, Monomictic lakes, Polymictic lakes, Deposition, Model studies.

Four processes are important in causing either sediment focusing or overestimation of sediment accumulation rates by traps, or both. The processes are organic degradation, sliding and slumping on slopes, peripheral wave action, and random redistribution of sediment. A simple model to predict the occurrence of these events was constructed from published data for monomictic and polymicic lakes which contained sufficient detail to identify the major redistribution process. Boundaries between the regions where different mechanisms dominate were calculated from the expected mode of operation of the processes. The model was commate were calculated from the expected mode of operation of the processes. The model was tested using sediment trap and accumulation rate vs. water depth data from the literature. Other published work is in general agreement with the predictions of the model. (Author's abstract) W87-00376

MAGNETIC STUDIES OF EROSION IN A SCOTTISH LAKE CATCHMENT, 1, CORE CHRONOLOGY AND CORRELATION, Liverpool Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
P. G. Appleby, J. A. Dearing, and F. Oldfield. Limnology and Oceanography, Vol. 30, No. 6, p 1144-1153, November 1985. 9 fig. 2 tab, 23 ref.

Descriptors: *Lakes, *Sedimentation, *Magnetic studies, *Erosion, Scour, Paleomagnetism, Scotland, Cores, Loch Frisa, Secular variations, Deposition, Chronology, Forest management, Farming.

Magnetic susceptibility, 210-Pb, 137-Cs, 14-C, and paleomagnetic secular variation are used to establish the chronology of sedimentation in a set of cores from Loch Frisa in western Scotland. The 14-C dates obtained are not compatible with the chronology derived from all the other techniques and this is ascribed to inwash of 'old' particulate carbon from the watershed. Central cores show little evidence of changes in sedimentation rate over the last 150 years whereas marginal cores contain evidence of major increases arising form ploughing and from drainage associated with catchment afforestation since 1935. The results illustrate the value of a multiple core approach to sedimentation and erosion studies even where complex lake morphometry precludes calculation of sediment budgets. (Author's abstract)

TRACKING OF FLOAT-DROGUES IN LAKE WATER CIRCULATION INVESTIGATIONS, Dundee Univ. (Scotland). Dept. of Geology. Por primary bibliographic entry see Field 2H. W87-00405

LAVSED-I-A MODEL FOR PREDICTING EROSION IN BASINS AND TRANSFER OF FINE SEDIMENTS IN NORDIC WATER-SHEDS, (UN MODELE POUR PREDIRE L'EROSION DES BASINS ET LE TRANSFERT DE SEDIMENTS FINS DAUS LES COARS D'EAU NORDIQUES),

Laval Univ., Quebec. Dept. of Civil Engineering. For primary bibliographic entry see Field 2E. W87-00441

LAVSED-II-A MODEL FOR PREDICTING SUS-PENDED LOAD IN NORTHERN STREAMS, Laval Univ., Quebec. Dept. of Civil Engineering. P. Y. Julien, and M. Frenette. dian Journal of Civil Engineering CJCEB,

Erosion and Sedimentation—Group 2J

Vol. 13, No. 2, p 162-170, April 1986. 9 fig, 3 tab, 9

Descriptors: *Streams, *Model studies, *Soil ero-sion, *Sediment yield, *Mathematical models, Mathematical studies, Suspended load, Rainfall, Snowmelt, Watersheds, Canada, St. Lawrence ates. Sediment tran

River, Climates, Sediment transport.

The model LAVSED-II was developed to evaluate the suspended load in northern streams that results from rainfall and snownelt erosion on upslope areas. The most important parameters are (1) the physical characteristics involved in soil erosion processes and (2) the climatic parameters on a month-to-month basis. Two fundamental relationships are obtained from the governing physical processes and empirical relationships describing snowmelt and sediment transport. The model has been applied to four large watersheds, tributaries of the St. Lawrence River. The computed sediment yield compares extremely well with the measured suspended load (mostly wash load) in the rivers. The magnitude of the peak during spring is particularly well predicted. The computed sediment yield is shown to be very sensitive to meteorological data. In the case of ungaged watersheds, the model can be applied to estimate the sediment yield. (See also W87-00441) (Author's abstract) W87-00442

VALIDITY OF A DEPTH-INTEGRATED MODEL FOR SUSPENDED SEDIMENT TRANSPORT,

Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.

Z. B. Wang, and J. S. Ribberink.

Journal of Hydraulic Research, Vol. 24, No. 1, p 53-67, 1986. 7 fig, 1 tab, 8 ref. append.

Descriptors: *Sediment transport, *Mathematical models, *Suspended sediment, Mathematical analysis, Theoretical analysis, Mathematical equations.

A theoretical analysis, mathematical equations. A theoretical and experimental investigation was carried out on the validity of a depth-integrated model for suspended sediment transport based on an asymptotic solution of the two-dimensional convection-diffusion equation. From the theoretical study, some requirements for the validity of the model in terms of flow and sediment parameters were found. The experimental study shows an acceptable agreement between theory and measurement. It was concluded that the model is valid in cases where the suspended load is the main mode of sediment transport and in cases where the flow variations are slow/gradual with respect to an obtained time/length scale. (McFarlane-PTT) W87-00494

SUSPENDED SEDIMENT - RIVER FLOW ANALYSIS, Utah State Univ., Logan. Dept. of Civil and Envi-

ronmental Engineering.
For primary bibliographic entry see Field 5B.
W87-00523

EXPERIMENTAL DISTURBANCE AND THE MAINTENANCE OF SPECIES DIVERSITY IN A STREAM COMMUNITY, North Carolina Univ. at Chapel Hill. Dept. of

For primary bibliographic entry see Field 2H. W87-00572

COMPUTER SIMULATION OF WATER DROP IMPACT IN A 9.6-MM DEEP POOL, California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 2B.
W87-00604

EFFECTS OF TILLAGE AND RAINFALL SIM-ULATION DATE ON WATER AND SOIL

LOSSES, Wisconsin Univ.-Madison. Dept. of Soil Science. For primary bibliographic entry see Field 2A. W87-0605

ENERGY DISSIPATION FOR WATER DROP IMPACT INTO SHALLOW POOLS, California Univ., Davis. Dept. of Land, Air and Water Resources.

water Resources. A. G. Ferreira, and M. J. Singer. Soil Science Society of America Journal SSSJD4, Vol. 49, No. 6, p 1537-1542, November-December 1985. 9 fig. 1 tab, 19 ref.

Descriptors: *Rainfall, *Fluid drops, *Shallow water, *Soil erosion, Rainfall mechanics, Drop impact, Energy balance.

impact, Energy balance.

The presence of a shallow layer of water over the soil during a rainfall event is associated with more soil loss than the sum of the soil loss produced by rainfall and overland flow separately. The mechanism for this increase in raindrop effectiveness is not fully understood. Rain drops (3.2-mm diam) that were falling at close to terminal velocities into static water, were photographed (at 1000 frames/second). During impact crater closing, soil from the pool bed was lifted. The kinetic energy during crater closing generally reached a larger value than during crater opening. For pool depths larger than one drop diameter and for impact velocities that are close to drop terminal velocity, after the first millisecond the kinetic energy development during the crater recession reaches values larger than during crater development, provided a bubble is not formed. During the crater opening the deformable bottom absorbs more energy than the nondeformable bottom. An increase in drop impact energy increases the maximum water depth that will produce the maximum water depth that will produce the maximum soil erosion. Rain impact on a dry soil will break up the soil aggresses and compact the soil. The reasonat will be will produce the maximum soil erosion. Rain impact on a dry soil will break up the soil aggregates and compact the soil. The transport will be minimal because it is only affected by the droplets ejected from the crown. If a layer of water is formed over the soil and the rain continues, detachment, lifting, and suspension take place and the transport occurs at a higher rate than for either the overland flow or the rainfall separately. (Peters-TTT) PTT) W87-00609

SIMPLE MODEL OF SEDIMENT-LADEN FLOWS,

Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab. For primary bibliographic entry see Field 2E. W87-00620

SEGMENTAL HYDRAULIC SIMILARITY IN ONE-DIMENSIONAL RETARDING FLOW,

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 5, p 419-428, May 1986. 6 fig, 1 tab, 5 ref.

Descriptors: *Hydraulic models, *Retarded flow, *Reservoirs, *Sediment disposition, Nonuniform flow, Flumes, Bed load, Laboratory methods, Sim-

A method for modeling large scale alluvial proc-esses involving long stretches of nonuniform flows is based on segmental hydraulic simulation. Rele-vant similarity criteria are developed based on the basic gradually varied flow equation. The validity of the approach is demonstrated through the re-sults of wide-range numerical applications and lim-ited data from flume experiments. A relatively short laboratory flume can be used effectively for simulating a long reservoir in several consecutive segments by sequentially varying the flow and acdiment conditions at the entrance and exit sec-tions of the flume. (Swanigan-PTT) tions of the flume. (Swanigan-PTT)

MATHEMATICAL MODELING OF SUSPEND-ED SEDIMENT IN NONUNIFORM FLOWS, Waterloopkundig Lab. te Delft (Netherlands). L. C. van Rijn. Journal of Hydraulic Engineering (ASCE) JHEND8, Vo. 112, No 6, p 433-455, June 1986. 19 fig. 21 ref fig, 21 ref.

Descriptors: *Mathematical models, *Suspended sediments, *Nonuniform flow, Hydraulics, Fluid

flow, Bed load, Fall velocity, Stochastic process, Open channels.

A two-dimensional vertical mathematical model for suspended sediment is based on the width-integrated convection-diffusion equation for the sediment particles including setting effects. Local fluid velocities and mixing coefficients are described by a new profile model. Measured and computed velocities of strongly nonuniform flows were used for calibration of the profile model. A stochastic approach is introduced to represent the sediment input at the bed. The convection-diffusion equation is solved by a finite-element method. A sensitivity analysis is presented to show the influence of the main controlling parameters. A verification analysis is presented using flume and field data of dredged trenches. (Swanigan-PTT) W8T-00625 W87-00625

SIMULATION OF MISSOURI RIVER BED DEGRADATION,

Iowa Univ., Iowa City. Inst. of Hydraulic Re-For primary bibliographic entry see Field 4A. W87-00628

WASHLOAD AND FINE SEDIMENT LOAD. Colorado State Univ., Fort Collins. Dept. of Civil

H. S. Woo, P. Y. Julien, and E. V. Richardson Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 6, p 541-545, June 1986. 2 fig. 11 ref.

Descriptors: *Wash load, *Sediment load, Sediments, Bed load, Flow discharge, Channels, Streams.

This technical note clarifies and defines 'washload' and 'fine sediment load' as they refer to flows in channels and coarse bed streams. Fine sediment load refers to silts and clays and washload refers to the part of the total load that is washed through the channel and not found in significant quantity in the bed. In streams with large concentrations of fines, the sediment size may be much smaller than 0.0625 mm. The fluid becomes very viscous at low concentrations of clay and the reduced settling inhibits the exchange of sediment particles between the bed and the suspension. In coarse bed streams, sands and fine gravels may be considered as washload as long as the sediment transport capacity remains larger than the availability of the sediment. Different conditions prevail intermittently when the upstream supply exceeds the transport capacity. (Peters-PUT) W87-00630

STUDY OF SYNTHETIC SEDIMENTGRAPHS FOR UNGAGED WATERSHEDS,

Transviron, Inc., Lutherville, MD. V. J. Chen, and C. Y. Kuo. Journal of Hydrology JHYDA7, Vol. 84, No. 1/2, p 35-54, April 15, 1986. 9 fig, 5 tab, 15 ref.

Descriptors: *Sediment discharge, *Hydrographs, *Ungaged watersheds, *Sediment yield, Sediment crosion, Storms, Unit sedimentgraph, Rainfall, Mathematical models.

A new rigorous procedure was developed to generate unit sedimentgraphs from ungaged watersheds. The model is based on a 1-hr sedimentgraph, which is defined as the direct sedimentgraph resulting from one unit of effective sediment yield of a storm of 1 hr duration generated uniformly over the basin at a uniform rate. Thus, the 1-hr sediments the basin at a uniform rate. Thus, the 1-hr sedi-mentgraph of a storm for a specific watershed can be generated by convolving the 1-hr unit sediment-graph with the effective sediment erosion of 1 hr duration provided that the rainfall record and characteristics of soil and watershed are known. Results of both 'spatial' and 'temporal' verification of the developed model show that agreements be-tween synthetic and actual sedimentgraphs are fairly acod (Author's hattract). fairly good. (Author's abstract) W87-00633

Group 2J—Erosion and Sedimentation

EFFECT OF SEDIMENT ON EARTHQUAKE-INDUCED RESERVOIR HYDRODYNAMIC RESPONSE, Delaware Univ., Newark. Dept. of Civil Engineer-

For primary bibliographic entry see Field 8B. W87-00732

TRACTIVE STRESS AND THE ONSET OF BED PARTICLE MOVEMENT IN GRAVEL STREAM CHANNELS: DIFFERENT EQUATIONS FOR DIFFERENT PURPOSES, McGill Univ., Montreal (Quebec). Dept. of Geography. raphy.
For primary bibliographic entry see Field 2E.
W87-00787

DISTRIBUTION OF POTENTIAL MACROFOS-SILS IN LAKE DOBSON, TASMANIA, Tasmania Univ., Hobart (Australia). Dept. of Botany. nary bibliographic entry see Field 2H. For primar W87-00796

TURBULENT STRUCTURE IN A RIVER Hydraulics Research Station, Wallingford (Engnd). For primary bibliographic entry see Field 2E. W87-00823

STABLE CHANNELS WITH MOBILE GRAVEL BEDS, University of East Anglia, Norwich (England). School of Environmental Sciences. For primary bibliographic entry see Field 2E. W87-00824

ARMORING AND SORTING SIMULATION IN **ALLUVIAL RIVERS** Iowa Univ., Iowa City. Inst. of Hydraulic Re-For primary bibliographic entry see Field 2E. W87-00826

2K. Chemical Processes

FATE OF NUCLIDES IN NATURAL-WATER SYSTEMS, Yale Univ., New Haven, CT. Dept. of Geology and Geophysics. For primary bibliographic entry see Field 5B. W87-00036

APPARATUS FOR GROUND WATER CHEM-ISTRY INVESTIGATIONS IN FIELD CAIS-

Los Alamos National Lab., NM. E. J. Cokal, E. Stallings, R. Walker, J. W. Nyhan, and W. L. Polzer.

ann w. L. Folzer. IN: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 348-356.

Descriptors: *Chemical analysis, *Groundwater, *Apparatus, *Field caissons, *Experimental design, Experimental data, Peristaltic pumps, Reliability, Calcium chloride, Water sampling, Sample prepa-

Los Alamos is currently in its second season of groundwater chemsitry and hydrology experimentation in a field facility that incorporates clusters of six, 3-meter diameter by 6-meter deep, soil-filled caissons and required ancillaries. Initial experience gained during the 1983 field season indicated the need for further development of the technology of this type of experimentation supporting hydrologic waste management research. The presentation included discussion of the following topics: (1) Uniform field application of water/matrix solutions to the caisson. Study of various devices employed for the uniform application of water to field-scale experimental plots suggested that none would be

acceptable in terms of spatial and temporal uni-formity. A development program was initiated to address this need, and has resulted in the deploy-ment of systems employing adjustable peristaltic pumps and 1P24T 'SCANIVALVE' fluidic wafer pumps and 1P24T 'SCANIVALVE' fluidic wafer switches ganged on a common driving shaft. A battery-powered relaxation oscillator provides timing signals used to advance the SCANI-VALVE stepping motor drive; and use of battery-powered pumps and flowmetering instrumentation renders the system immune to line power failures. An extended program of solution delivery tests indicates that if kept free of particulate matter and algal growth, the system possesses the required reliability and uniformity of application. (2) Matrix and tracer solution blending/storage. Since continuous application of a calcium chloride solution (200 mg/l as Ca) is required for current experiments, it was necessary to provide for continuous blending and storage of this solution as a separate unit operation, by metering a concentrated solution into a stream of well water. The blended stream is continuously fed into a holding tank which has capacity for ca. 2 1/2 days of operation. In this continuously fed into a holding tank which has capacity for ca. 2 1/2 days of operation. In this way, storage is adequate to permit uninterrupted operation over a weekend. (3) Devices for groundwater sampling. The caissons are fitted with eight sampling ports arranged vertically, and accessible from a central caisson. The ports are in turn fitted with horizontal boreholes into which porous cups or other sampling devices can be deployed. (See also W87-00049) (Lantz-PTT) W87-00065

DYNAMIC NITROGEN BALANCE MODEL FOR RIVER SYSTEMS, Institute of Hydrology, Wallingford (England). P. G. Whitehead, and R. J. Williams.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 89-99, 5 fig, 1 tab. 9 ref.

Descriptors: *Nitrogen, *Dynamic models, *Rivers, Thames River, England, Denitrification, Water pollution sources, Effluents, Surfacegroundwater relations, Model studies, Surface moff, Tributaries, Groundwater

As part of a collaborative study with Thames Water Authority a multi-reach, multi-tributary flow and quality model has been developed for the Thames River System. The model accounts for sources of nitrogen from effluent discharges, tributaries, surface-runoff and groundwater and losses of nitrogen via abstracted water and denitrification processes. The model is dynamic in that it describes the day to day variations in water quality, and can therefore be used either in a real time forecasting role to predict the arrival time of poor quality water at key abstraction sites or, in a design role, to provide information on the probability distribution of water quality at these locations. (See also W87-00127) (Author's abstract) W87-00134

SEDIMENT AND NUTRIENT DISCHARGE THROUGH STREAMFLOW FROM TWO EXPERIMENTAL WATERSHEDS IN MATURE OAK-BECKH FOREST ECOSYSTEM NEAR ISTANBUL, TURKEY, Istanbul Univ. (Turkey). Faculty of Forestry. For primary bibliographic entry see Field 2J. W87-00153

USE OF THE CHLORIDE ION IN DETERMIN-ING HYDROLOGIC-BASIN WATER BUDGETS
- A 3-YEAR CASE STUDY IN THE SAN JUAN MOUNTAINS, COLORADO, USA, MOUNTAINS, CUIDARAID, USA, Geological Survey, Denver, CO. H. C. Claassen, M. M. Reddy, and D. R. Halm. Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 49-71, June 15, 1986. 5 fig. 7 tab, 15 ref. DOE Agreement No. DE-A108-76DP00474.

Descriptors: *Chlorides, *Hydrologic budgets, *San Juan Mountains, *Colorado, Precipitation, Recharge-runoff relationships, Water resources

planning, Basins, Evaporation, Model studies, Groundwater.

Measurement of chloride concentration and water equivalent in precipitation and recharge at a site can be extrapolated to determine available moisture in a nearby basin. This method may also be extrapolated to a basin with similar climatic characteristics if precipitation, vegetation, and topographic data are available. The average accuracy of the total of evaporation, recharge, and runoff (assuming no storage) was about 10% of total precipitation. Soil-moisture measurements indicate the entire 10% error in moisture balance can be attributed to annual changes in storage. Data requirements for the method are considerably less than data requirements for energy-budget methods to determine available moisture. Potential applications of the method to hydrologic problem-solving are: (1) estimating total available moisture from chloride concentrations in groundwater or surface water or both; (2) modeling paleoclimate scenarios and evaluating their correctness by comparison with paleo-groundwater chloride concentrations; and, (3) providing an independent comparison for water budgets obtained by energy-budget methods. Obviously the method cannot be applied readily to systems with a lithologic source of chloride. Most systems primarily consisting of unff, intrusive volcanic rock, nonmarine sediments, quartzite, and other metamorphic rocks will be suitable for application of the model. (Author's abstract) W87-00154

NUMERICAL LUMPED-PARAMETER MODEL FOR SIMULATING THE ISOTOPIC EVOLUTION OF CLOSED-BASIN LAKES, New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience. For primary bibliographic entry see Field 2H. W87-00155

DIRECT MEASUREMENT OF ATP AND ADE-NINE NUCLEOTIDE POOL TURNOVER IN MICROORGANISMS: A NEW METHOD FOR ENVIRONMENTAL ASSESSMENT OF ME-

ENVIRONMENTAL ASSESSMENT OF METABOLISM, ENERGY FLUX AND PHOSPHORUS DYNAMICS,
Hawaii Univ., Honolulu. Dept. of Oceanography.
For primary bibliographic entry see Field 2H.
W87-00163

MIRES OF JAPAN IN RELATION TO MIRE ZONES, VOLCANIC ACTIVITY AND WATER

CHEMISTRY,
Hokkaido Univ., Sapporo (Japan). Graduate
School of Environmental Science. L. Wolejko, and K. Ito.

Japanese Journal of Ecology, Vol. 35, No. 5, p 575-586, March, 1986. 5 fig. 3 tab, 55 ref.

Descriptors: *Bogs, *Wetlands, *Chemical properties, *Vegetation, Mine zones, Hydrology, Marsh plants, Ferns, Marshes, Nutrients, Japan.

plants, Ferns, Marshes, Nutrients, Japan.

Japanese mires are discussed in terms of volcanic activity and chemical properties of river waters and volcanic ash. A type of mire resembling the Hochmoor developed on tephras is described along with the concept of the tephratrophic mire, a kind of mire renewing under the influence of tephras. It is proposed that wetlands vegetation be classified on the basis of water chemistry and hydrology rather than by morphological features. According to this proposal, mires in Hokkaido may be classified as follows: the bog and fen part of the tephratrophic mixed mire, the mountain tephratrophic fen, several types of lowland fens, and fen swamp (alder swamp). In addition, five mire zones in Japan are distinguished vertically and horizontally by mire types and presence or absence of peat: the zone of mountain bog of Hokkaido, the zone of raised bog of Hokkaido, the zone of raised bog of Hokkaido, the zone of raised bog of horthern Honshu, the traditional zone, and the zone of peatless mires of southern Japan. (Geiger-PTT) W87-00182

WATER CYCLE—Field 2

Chemical Processes—Group 2K

DETERMINATION OF GLYPHOSATE HERBI-DETERMINATION OF GLYPHOSATE HERBI-CIDE AND (AMINOMETHYL)PHOSPONIC ACID IN NATURAL WATERS BY LIQUID CHROMATOGRAPHY USING PRE-COLUMN FLUOROGENIC LABELING WITH 9-FLUOR-ENYLMETHYL CHEOROFORMATE, Florids Univ., Gainesville. Dept. of Food Science and Human Nutrition. For primary bibliographic entry see Field 5A. W87-00212

TITRATION OF SULPHIDES AND THIOLS IN

NATURAL WATERS, Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemis-

D. Dyrssen, and M. Wedborg. Analytica Chimica Acta ACACAM, Vol. 180, p 473-479, February 1986. 4 fig, 12 ref.

Descriptors: *Water analysis, *Boulegue procedure, *Sulfide, *Thiols, *Thiosulphate, *Sulfite, Mercuric chloride, Titration, Chemical analysis.

The concentrations of the species present during the procedure of Boulegue for determination of sulfide, thiols, thiosulfate, and sulfite in mineral water by titration with mercury (II) chloride were calculated and functions suitable for the evaluation of the equivalence points were derived. It is shown that the halide ions in seawater interfere only with the titration of sulfite. (Author's abstract) W87-00264

PRECONCENTRATION BY DITHIOCARBA-MATE EXTRACTION FOR DETERMINATION OF TRACE ELEMENTS IN NATURAL WATERS BY INDUCTIVELY-COUPLED PLASMA ATOMIC EMISSION SPECTROME-

Kyoto Univ., Uji (Japan). Inst. for Chemical Re-search.

M. Sugiyama, O. Fujino, S. Kihara, and M. Matsui. Analytica Chimica Acta ACACAM, 181, p 159-168, March 31, 1986. 5 fig, 4 tab, 16 ref.

Descriptors: *Dithiocarbamate extraction, *Trace elements, *Water analysis, *Atomic emission spectrometry, Arsenic, Selenium, Molybdenum, Zinc, Cadmium, Tin, Iron, Chromium, Lead, Vanadium, Copper, Manganese, Hydrogen ion concentration, Chelating agents.

Preconcentration by dithiocarbamate extraction into 2-ethylhexyl acetate for simultaneous determination of trace elements in natural water is described. After 250-fold concentration, the organic phase is used directly for inductively-coupled plasma atomic emission spectrometry. Thirteen elements (As, Se, Mo, Zn, Cd, Ni, Co, Sn, Fe, Cr(VI), Pb, V, and Cu) are simultaneously concentrated at pH 4.3 with the combination of ammonium tetramethylenedithiocarbamate and are determined in the extract. Mn and Cr(III) are also determined after preconcentration at pH 6.9 with the same chelating agents. Results of analysis of Lake Biwa (Japan) waters by the method are described. (Author's abstract) W87-00265

DETERMINATION OF THALLIUM IN SEDI-MENTS AND NATURAL WATERS, Liverpool Univ. (England). Dept. of Oceanogra-

phy.
J. P. Riley, and S.A. Siddiqui.
Analytica Chimica Acta ACACAM, Vol 181, p
117-123, March 31, 1986. 4 tab, 10 ref.

Descriptors: *Water analysis, *Thallium, *Sea water, *Thermal atomic absorption spectrometry, *Anodic stripping voltammetry, Deep-sea sedi-ments, Anion-exchange resin, Chemical analysis.

Thallium may be routinely determined in natural waters (including sea water) by first preconcentrating it by adsorption from oxidizing medium onto a strongly basic anion exchanger such as the tetrachlorothallate(III) ion. After elution with sulfur dioxide and evaporation, thallium is estimations.

ed either by graphite-furnace atomic absorption spectrometry or by differential-pulse anodic striping voltammetry. Relative standard deviations of 4% were found for both endpoints at thallium concentrations of 15 nanogram/liter. There was good agreement between the results obtained by the two techniques. The technique is also applied to digests from deep-sea sediments. (Author's absuract) W87-00266

CHEMICAL DERIVATIZATION ANALYSIS OF PESTICIDE RESIDUES, X. ANALYSIS OF TEN ACID HERBICIDES IN NATURAL WATERS, Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 5A. W87-00271

PREDICTING SALINIZATION AND SODIFI-CATION OF A BARE SANDY LOAM SOIL AFTER IRRIGATION WITH POOR-QUALITY WATER INTERSPERSED WITH RAIN, Haryana Agricultural Univ., Hissar (India). Dept. of Soils.

For primary bibliographic entry see Field 3C. W87-00272

ACCUMULATIVE SAMPLING OF TRACE PES-TICIDES AND OTHER ORGANICS IN SUR-FACE WATER USING XAD-4 RESIN, California Univ., Davis. Dept. of Environmental Toxicology.
For primary bibliographic entry see Field 5A.
W87-00274

DYNAMIC THERMAL STRIPPING PROCE-DURE FOR THE ANALYSIS OF FUEL OIL NO. 2 AND KEROSENE IN WATER.

Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD. For primary bibliographic entry see Field 5A. W87-00277

CHEMICAL DIFFERENCES BETWEEN EVENT AND WEEKLY PRECIPITATION SAMPLES IN NORTHEASTERN ILLINOIS, CHEMICAL Argonne National Lab., IL. Environmental Research Div.

For primary bibliographic entry see Field 5B. W87-00283

SCAVENGING RATIOS OF ACIDIC POLLUT-ANTS AND THEIR USE IN LONG-RANGE TRANSPORT MODELS, Ontario Ministry of the Environment, Toronto. Air Resources Branch.

For primary bibliographic entry see Field 5B. W87-00284

TRACE ORGANIC COMPOUNDS IN RAIN - II. GAS SCAVENGING OF NEUTRAL ORGANIC

GAS SCAVENGING OF NEUTRAL ORGANIC COMPOUNDS,
Oregon Graduate Center, Beaverton. Dept. of Chemical, Biological, and Environmental Sciences. For primary bibliographic entry see Field 5B. W87-00285

PERSONAL PERSONAL EXPOSURES, INDOOR-OUT-DOOR RELATIONSHIPS, AND BREATH LEVELS OF TOXIC AIR POLLUTANTS MEAS-URED FOR 355 PERSONS IN NEW JERSEY, ntal Protection Agency, Research Triangle Park, NC. For primary bibliographic entry see Field 5B. W87-00287

PRECIPITATION CHEMISTRY AFFECTED BY DIFFERENCES IN LOCATION OF COLLEC-DIFFERENCES IN LOCATION OF COLLEC-TION SITES AND STORAGE METHODS, Maritimes Forest Research Centre, Fredericton (New Brunswick). For primary bibliographic entry see Field 2B. W87-00288

Aarhus Univ. (Denmark). Inst. of Ecology and Genetics. For primary bibliographic entry see Field 5B. W87-00289

EMISSIONS OF BIOGENIC SULFUR GASES

FROM A DANISH ESTUARY,

SOURCE APPORTIONMENT OF WET SUL-FATE DEPOSITION IN EASTERN NORTH AMERICA,

Massachusetts Inst. of Tech., Cambridge. Energy

For primary bibliographic entry see Field 5B. W87-00290

BIOGENIC AND ANTHROPOGENIC ORGANIC COMPOUNDS IN RAIN AND SNOW SAMPLES COLLECTED IN SOUTHERN CALIFOR NIA.

California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 5B.

W87-00295

W87-00372

VARIATION IN TRACE METAL EXPORTS FROM SMALL CANADIAN SHIELD WATER-

Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre. For primary bibliographic entry see Field 5B. W87-00329

ANAEROBIC METHANE OXIDATION RATES AT THE SULFATE-METHANE TRANSITION IN MARINE SEDIMENTS FROM KATTEGAT AND SKAGERRAK (DENMARK),

Aarhus Univ. (Denmark). Inst. of Ecology and Genetics. For primary bibliographic entry see Field 2L.

PARTICULATE AND OPTICAL PROPERTIES DURING CACO3 PRECIPITATION IN OTISCO

Rochester Univ., NY. Dept. of Biology. For primary bibliographic entry see Field 2H. W87-00373

MODELING OF DISSOLVED SOLIDS IN A RIVER USING FLOW COMPONENTS (MO-DELISATION DES SOLIDES DISSOUS EN RI-VIERE A L'AIDE DES COMPOSANTES DE L'ECOULEMENT),

Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). For primary bibliographic entry see Field 5B. W87-00443

SULFATE AND NITRATE CHEMISTRY IN CU-MULIFORM CLOUDS,

Washington Univ., Seattle. Dept. of Atmospheric

For primary bibliographic entry see Field 5B. W87-00457

RANK CORRELATION FOR SCREENING PRECIPITATION CHEMISTRY DATA,

Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 7A. W87-00465

DETERMINATION OF DEUTERIUM IN WATER BY GAS-PHASE INFRARED SPECTROPHOTOMETRY, Florida State Univ., Tallahassee. Dept. of Chemis-

J. J. Shakar, C. K. Mann, and T. J. Vickers. Analytical Chemistry ANCHAM, Vol. 58, No. 3, p 1460-1461, June 1986. 1 fig, 1 tab, 7 ref.

Group 2K—Chemical Processes

Descriptors: *Chemical analysis, *Water analysis, *Deuterium, *Spectrophotometry, *Infared spec-

The sensitivity of gas-phase infrared spectrophotometry for the determination of deuterium in water is evaluated. Syringe injection of 20 microliters of sample into a heated 10 cm path-length cell is shown to provide a detection limit of about 60 ppm. The analytical response is shown to be linear with concentration from natural abundance (150 ppm) to at least 1.8 atom percent deuterium. The sensitivity of 300 ppm would indicate the utility of the vapor-phase infrared method for body water volume studies. (McFarlane-PTT) W87-00484

CARBON CYCLE FOR LAKE WASHINGTON -A STABLE ISOTOPE STUDY, Washington Univ., Seattle. Dept. of Geological Sciences.

For primary bibliographic entry see Field 2H. W87-00564

ORGANIC CARBON IN THE CAURA RIVER,

Cornell Univ., Ithaca, NY. Ecosystems Research

For primary bibliographic entry see Field 2H. W87-00568

CONTROLS ON SILICA IN GROUNDWATER ENVIRONMENTS IN THE UNITED KING-

Birmingham Univ. (England). Dept. of Geological For primary bibliographic entry see Field 2F. W87-00584

DETERMINATION OF THE COMPONENTS OF STORMFLOW USING WATER CHEMIS-TRY AND ENVIRONMENTAL ISOTOPES, MATTOLE RIVER BASIN, CALIFORNIA, Geological Survey, Menlo Park, CA. For primary bibliographic entry see Field 2E. W87-00637

NEW ION-SELECTIVE ELECTRODE FOR NI-TRATE DETERMINATION, Muenster Univ. (Germany, F.R.). Anorganisch

Chemisches Inst.
O. G. B. Nambiar, J. Weinzierl, and F. Umland.

Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, p 322:327-328, January 1985. 2 fig, 1

Descriptors: *Chemical analysis, *Nitrates, Water analysis, Nitrification, Electrodes.

A new ion-selective electrode which can be used A new ion-selective electrode which can be used for nitrate determination in a concentration range of .1 to .0001 mol/1 is described. The polymer ion-exchanger membrane is formed by an epoxy resin, after Nitron nitrate is introduced to serve as an anchor group. The selectivity constants K sub T-I have been determined for Cl(-), ClO4(-), HCO3(-), SO4(2-), HPO4(2-) and O4(2-) and WO4(2-) and clouds. The interfering effect of Cl(-) and ClO4(-) ions is rather strong, so that these ions have to be removed before measurement. (Author's abstract) W87-20648

EFFECTS OF PH UPON THE ENVIRONMEN-TAL FATE OF (14C)FENTIROTHION IN AN AQUATIC MICROCOSM,
Ohio State Univ., Columbus. Dept. of Entomolo-

gy. For primary bibliographic entry see Field 5B. W87-00683

STABLE CARBON ISOTOPES OF HCO3(-) IN THE AQUIA AQUIFER, MARYLAND: EVI-DENCE FOR AN ISOTOPICALLY HEAVY SOURCE OF CO2, Geological Survey, Towson, MD.

For primary bibliographic entry see Field 5B. W87-00685

GAS CHROMATOGRAPHIC ANALYSIS OF TRACE METALS ISOLATED FROM AQUE-OUS SOLUTIONS AS DIETHYLDITHIOCAR-

BAMATES, Concordia Univ., Sir George Williams Campus, Montreal (Quebec). Dept. of Chemistry. N. J. Carvajal, and R. H. Zienius. Journal of Chromatography JOCRAM, Vol. 355, No. 1, p 107-116, March 14, 1986. 3 fig, 4 tab, 33

Descriptors: *Gas chromatography, *Chemical analysis, *Diethyldithiocarbamates, Trace metals, Trace elements, Metals, Aqueous solutions, Seawater, Reagents.

While the determination of trace levels of metal ions in sea waters and other marine samples can be accomplished by spectroscopic means (atomic absorption or inductively coupled plasma) recent publications describing the determination of metal ions as diethyldithicarbamate derivatives has raised the possibility of using gas chromatographic techniques. A study was undertaken to establish optimum procedures both for the isolation of trace metals as diethyldithicarbamates from aqueous media and for their quantitation by gas chromatography. The diethyldithicarbamate standards required for this study (i.e. those of Ni(II), Cu(II), raphy. The diethyldithiocarbamate standards required for this study (i.e. those of Ni(II), Cu(II), Zn(II), Cd(II), Pb(II), Hg(II) and Co(III)) were prepared and characterized. A gas chromatographic method was developed, involving the use of the mixed stationary phases QF-1 and OV-101 at low concentrations, which gave a highly efficient separation of mixtures of up to five of the metals studied. Contrary to other reports in the literature separation of mixtures of up to five of the metals studied. Contrary to other reports in the literature dealing with the gas chromatography of some metal diethyldithiocarbamate or other, the use of glass tubing to pack columns was found to be critical for obtaining successful separations, and elimination of possible degragation of the metal diethyldithiocarbamates on the columns. Linear responses were the rule in the nanogram concentration range investigated for each metal. Accuracy of analyses of ppm concentrations of the metals tion range investigated for each metal. Accuracy of analyses of ppm concentrations of the metals was in the order of approx. 5% or better. Low ppb (nanogram/ml) detection was feasible starting with metals dissolved in either distilled water, or in synthetic sea water. Theoretical principles have been proposed to account both for the nature of the gas chromatographic separation observed and for the degradation problems encountered and overcome. (Author's abstract)

COMPOSITIONAL CHANGE OF ORGANIC MATTER IN RAINWATER DURING PRECIPI-

MATTER IN RAINWATER DURING PRECIPI-TATION EVENTS, California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics. K. Kawamura, and I. R. Kaplan. Atmospheric Environment ATENBP, Vol. 20, No. 3, p 527-535, March 1986. 8 fig. 4 tab, 26 ref. EPA Assistance Agreement CR-807864-01.

Descriptors: *Organic matter, *Rain, *Chemistry of precipitation, *Chemical composition, Los Angeles, California, Hydrocarbons, Time series analysis, Mathematical studies, Fatty acids, Benzoic acids, Phenols, Chemical analysis.

Ten rain samples were collected at west Los Angeles, California, during two precipitation events. The samples were extracted with CH2Cl2 using a separatory funnel followed by continuous steam distillation extraction. Extracts were analyzed for n-alkanes, UCM of hydrocarbons, PAHs, FAs, benzoic acids and phenols using capillary gas chromatography. The concentrations of some compounds decrease with time, whereas those of other compounds increased during the precipitation. Fluctuations of organic concentrations with time are interpreted as being due to washout effect and transient input of organic matter during the precipitation event. The major factor controlling the inputs is suggested to be wind which carries the inputs is suggested to be wind which carries the organic constituents from biogenic and/or anthropogenic (motor vehicle) sources. The origins of air

masses scavenged during a rain event may be traced by analysis of the organic constituents in the rain water. (Author's abstract)

IN SEARCH OF A CHARACTERISTIC SIGNA-TURE FOR GROUNDWATER AQUIFERS - A CASE STUDY FROM ISRAEL, Flinders Univ. of South Australia, Bedford Park. School of Earth Sciences.

For primary bibliographic entry see Field 2F. W87-00788

REPETITIVE STRIPPING AND TRAPPING APPLIED TO THE DETERMINATION OF TRACE HYDROCARBONS IN AQUEOUS SAMPLES,

Ceskoslovenska Akademie Ved, Brno. Ustav Analyticke Chemi. For primary bibliographic entry see Field 5A. W87-00792

PRELIMINARY MODEL OF LONG-TERM CHANGES IN STREAM ACIDITY IN SOUTH-WESTERN SCOTLAND, Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

For primary bibliographic entry see Field 5G. W87-00822

2L. Estuaries

ESTUARINE COMPARISONS.

Estuarine Research Foundation.

Academic Press, New York. 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. Edited by Victor S. Kennedy. 709 p.

Descriptors: *Estuaries, *Estuarine environment, *Conferences, Marshes, Chang Jiang River, China, Anadromous fish, Sedimentation, Sediment transport, Saline-freshw ater interface

This proceedings of the Sixth Biennial Conference of the Estuarine Research Foundation continues the practices of publishing selected papers presented at Invited Sessions during the meetings. In the first section, a number of comparisons of different kinds are made among estuaries after attention has been drawn to problems associated with the making of measurements on which such comparisons are made. The second section includes review papers on aspects of the diverse interactions that occur on or in marsh soils, coupled with new and complementary information derived from recent studies. Another section examines the matter of retention of invertebrate larvae in seaward-draing estuaries, while the final section draws attention examines are made to the section of retention of inverteorate area in seaward-craining estuaries, while the final section draws attention to the Chang Jian estuary in China, juxtaposing historical data spanning two millenia with recent knowledge derived from use of space satellites. (See also W87-00006 thru W87-00035) (Lantz-PTT) W87-00005

SCALES OF VARIABILITY IN ESTUARINE ECOSYSTEMS, Dalhousie Univ., Halifax (Nova Scotia). Dept. of

Biology. M. R. Lewis, and T. Platt.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 3-19, 9 fig. 38 ref.

Descriptors: *Estuarine environment, *Variability, *Ecosystems, Dynamics, Bedford Basin, Nova Scotia, Spatial distribution, Temporal distribution, Biomass, Time series analysis, Phytoplankton, Photosynthesis, Nutrients, Light penetration.

Ecological dynamics in estuaries can be character ized in terms of spatial and temporal scales of variability. Data from Bedford Basin and other inlets on the Atlantic Coast of Nova Scotia are used to examine the scales of physical forcing and

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the scales of biological response. It was established that temporal scales for which these inlets appear to be autonomous with respect to the adjacent continental shelf (approximately < 3 days), and theoretical criteria for autonomy based on the distribution of biological variability in the frequency domain were developed. The spatial distribution of phytoplankton biomass is analyzed in the wavenumber spectrum is suggested, where growth processes are the principal determinants of the variance spectrum. On either side of this window, physical forces override biological processes. It is concluded that in estuaries, where physical forcing is often strong in amplitude and complex in frequency structure, it is particularly important to emphasize the scales of variability for both physical and biological processes and to recognize that time and space scales are intimately related. (See also W87-00006) (Author's abstract) W87_00006

LOCALIZED MIXING OF LOW SALINITY PATCHES IN A PARTIALLY MIXED ESTU-ARY (SOUTHAMPTON WATER, ENGLAND), Institute of Oceanographic Sciences, Taunton

Institute of Oceanographic Science, (England).
K. R. Dyer.
IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 21-36, 7 fig, 18 ref.

Descriptors: *Estuaries, *Saline water intrusion, *Mixing, *Southampton, *England, Salinity currents, Tidal currents, Saline-freshwater interfaces, Tidal effects, Ebb tides, Saline intrusion, Mixing.

The time scales of many chemical and biological processes are from minutes to hours and, for comparative studies, variations in the physical conditions of the same scale need to be considered. Observations within Southampton Water have shown the presence of intermediate scale patches of low salimity water. These patches, which appear to be caused by river flow variations, mix relatively slowly with the surrounding water masses. The mixing is greatest on the ebb flow at spring tides, and appears to be mainly restricted to a comparatively short reach of the estuary. The influence of these patches on chemical and biological processes could cause contrasts not otherwise apparent in could cause contrasts not otherwise apparent in comparative studies based on tidally averaged characteristics. (See also W87-0005) (Author's abstract) W87-00007

TEMPORAL AND SPATIAL CONSIDERATIONS IN MEASURING ESTUARINE WATER FLUXES,
South Carolina Univ., Columbia. Belle W. Baruch
Inst. for Marine Biology and Coastal Research.
B. Kjerfve, J. A. Proehl, F. B. Schwing, H. E. Sein, and M. Marozas.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 37-51, 8 fig, 1 tab, 13 ref. NSF Grant Nos. DEP76-83010 and DE80-04275.

Descriptors: *Tidal estuaries, *Estuaries, *Fluctua-tions, *Temporal distribution, *Spatial distribution, Ecology, Salt marshes, Tidal currents, Saline-freshwater interfaces, Sampling, Discharge fre-quency, Velocity, Tides, Statistical studies, North Inlet, South Carolina.

North Inlet, South Carolina, a tidal estuary with little fresh water input, is the site for a multi-year ecological field study of seasonal water and material fluxes between the coastal ocean and the estuary/salt marsh system. Large tidal currents and small residual fluxes make it difficult to determine budgets with confidence. In addition to large temporal flux variations, estuarine cross-sections exhibit systematic lateral residual current reversals, a surprising find in an estuary classified as well mixed. These tidally-driven circulation features introduce large spatial variations which must be accounted for in field sampling programs. An experiment was undertaken to select an optimum sam-

pling density and rate for discharge measurements in a 320 m wide estuarine cross-section. We found that simultaneous velocity measurements at meter intervals from surface to bottom, at three locations across the section, every 1.5 lunar hours, for at least one tidal cycle, was acceptable. Also, simultaneous discharge measurements, at two cross-sections along the same channel, yielded residual fluxes that could not be separated statistically. This lends more credence to the technique of calculating material fluxes from simultaneous, cross-sectional velocity and concentration measurements. (See also W87-00005) (Author's abstract) W87-00008

RELATIONSHIP BETWEEN PHYSICAL CHARACTERISTICS AND ORGANIC CARBON SOURCES AS A BASIS FOR COMPARING ES-TUARIES IN SOUTHERN NEW ENGLAND, Connecticut Univ., Groton. Marine Sciences Inst. B. L. Welsh, R. B. Whitlatch, and W. F. Bohlen. IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 53-67, 4 fig, 4 tab, 45 ref.

Descriptors: *Estuaries, *New England, *Organic carbon sources, *Physical properties, Size, Area, Volume, Tides, Benthos, Organic carbon, Ecosystems, Phytoplankton, Estuarine environment.

In an attempt to compare estuaries holistically, it was hypothesized that contributions of various carbon sources to production were strongly correlated to estuarine physical attributes (such as size, area:volume characteristics, or tidal characteristics). Based on a compilation of data from nine systems in southern New England, it was found that only the area: volume ratio correlated with any of the production components, but that those relationships were very strong with respect to benthic production (R(2) = 95%), total production (R(2) = 92%), and the benthic:pelagic production (R(2) = 92%), and the benthic pelagic production ratio (R(2) = 82%), where R(2) is the coefficient of determination. It is concluded that the relationof determination. It is concluded that the relationships answer the need for an easily obtained underlying physical parameter for comparing estuaries in terms of their autochthonous production components, and that these patterns are so strong that the area:volume ratio would have to be taken into consideration when seeking any additional relationships with other parameters. (See also W87-00005) (Author's abstract)

COMPARATIVE ANALYSIS OF NUTRIENTS AND OTHER FACTORS INFLUENCING ESTU-ARINE PHYTOPLANKTON PRODUCTION, Maryland Univ., Solomons. Chesapeake Biological

Lab. W. R. Boynton, W. m. Kemp, and C. W. Keefe. IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 69-90, 8 fig, 1 tab, 41 ref, 1 append.

Descriptors: *Estuaries, *Nutrients, *Phytoplank-ton production, Chemical analysis, Chorophyll a, Physical analysis, Statistical analysis, Estuarine en-vironment, Ecosystems, Geomorphology, Biomass, Nitrogen, Phosphorus, Chesapeake Bay.

Data concerning phytoplankton production, chlorophyll a, and associated phytical and chemical variables from 63 different estuarine systems are reviewed. Data were analyzed statistically to test hypotheses regarding algal productivity and factors regulating temporal patterns. Prior to statistical analysis, estuarine systems were classified into four groups based on criteria of physical circulation and geomorphology. Analysis of grouped data indicated that algal production and biomass were consistently high in warm periods of the year in a broad spectrum of estuaries and that ratios of available nitrogen to phosphorus were low during periods of high production, except in highly eutrophic systems. Phytoplankton production and biomass exhibited weak correlations with a variety of physical and chemical state variables, perhaps indicating the significance of rate processes as opposed to standing stocks in regulating these important fea-

tures of estuarine systems. A six-year time series of measurements of algal production and chlorophyll a at stations in middle Chesapeake Bay exhibited considerable year-to-year variability, with a three-fold range in peak values. Summertime maxima were strongly related to annual loadings of both nitrogen (N) and phosphorus (P) but annual production appeared to be sustained primarily on recycled nitrogen and phosphorus. To generalize from these findings, N and P loading rates were estimated for 14 different estuarine systems, and a significant positive relationship was obtained between phytoplankton production and nitrogen (but not phosphorus) inputs. (See also W87-00005) (Author's abstract) W87-00010

BIOCHEMICAL CORRELATES OF STRUC-TURE AND STABILITY IN DIVERGENT PLANKTON COMMUNITIES, Rhode Island Univ., Kingston. Graduate School of

Oceanography.
For primary bibliographic entry see Field 5A.
W87-00011

RESPONSES OF TEXAS ESTUARIES TO FRESHWATER INFLOWS,

Texas Univ. at Austin. Center for Research in Water Resources.

Water Accounces.

N. E. Armstrong.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 103-120, 3 fig, 7 tab, 38 ref.

Descriptors: "Estuaries, "Texas, "Freshwater in-flows, Saline-freshwater interfaces, Precipitation, Geomorphology, Hydrological aspects, Nutrient loading, Evaporation, Tidal effects, Fish popula-tions, Shellfish.

sons, Shellissa.

Six of the seven major estuarine systems on the Texas coast are compared using geomorphic, hydrologic, hydrographic, nutrient loading, and commerical fishery harvest indices as common bases. While the geomorphic characteristics of these systems are relatively similar, major differences are found in annual freshwater inflows, precipitation and evaporation patterns, and hydraulic residence times, as well as tidal exchange influenced residence times. Biotic composition is relatively similar except where salinity tolerance limitations reduce populations of finish and shellfish. Nutrient budgets show that nutrient inputs are dominated by freshwater inflows, with exchange from saltwater and delta marshes and precipitation providing a small fraction of the inflow. Finfish and shellfish harvests are shown to be functions of average salinity of the estuaries as well as of areal loading rates of nutrients. (See also W87-00005) (Author's abstract)

ANALYSIS OF ENVIRONMENTAL FACTORS REGULATING COMMUNITY METABOLISM AND FISHERIES PRODUCTION IN A LOUISI-

ANA ESTUARY, Louisiana State Univ., Baton Rouge. Coastal Ecol-

J. W. Day, C. S. Hopkinson, and W. H. Conner.
IN: Estuarine Comparisons, 1982. Proceedings of
the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 121-136, 4 fig. 5 tab, 48 ref. Louisiana Sea Grant College Program.

Descriptors: *Community metabolism, *Estuaries, *Louisiana, *Fishery production, Fisheries, Bararia Basin, Aquatic Primary Productivity, Ecosystems, Gulf of Mexico, Temporal distribution, Organic carbon, Chlorophyll a, Marshes, Nekton, Environmental effects, Wetlands.

Using information from the Barataria Basin, Louisiana, questions regarding controls on aquatic pri-mary productivity (APP) and the role of wetlands in the organic budget of this estuary and in sup-porting fisheries in Barataria Basin and the near-shore Gulf of Mexico are addressed. Gross APP

Group 2L—Estuaries

ranged from 1058 to 3286 g O2/sq m/yr. The highest values were in lakes with direct upland runoff, suggesting that these nutrient sources are important regulators of APP. Most of the water bodies of the Basin are heterotrophic and, to satisfy measured community respiration, significant inputs of allochthonous organic carbon are required. The importance of allochthonous inputs is qualitatively supported by the lack of correlation between temporal patterns of organic carbon and chlorophyli concentration and aquatic primary production in the water column. Most marine nekton species of the Basin spend only part of their life cycle in the estuary and they use the estuary in systematic and predictable ways. Shallow-water marsh areas have nekton biomass 7 to 12 times higher than that of open water areas. Young and juvenile nekton seek out these areas actively. (See also W87-00005) (Author's abstract) W87-00013

REVIEW OF PRIMARY PRODUCTION AND DECOMPOSITION DYNAMICS OF THE BE-LOWGROUND MARSH COMPONENT, Rutgers - The State Univ., Camden, NJ. Dept. of Biology. nary bibliographic entry see Field 2H.

BACTERIA AND MICROBIAL DISTRIBUTION IN ESTUARINE SEDIMENTS, Whitman Coll., Walla Walla, WA. Dept. of Biology. P. A. Rublee.

P. A. RUDIE-IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 159-182, 5 fig. 4 tab, 52 ref.

Descriptors: "Bacteria, "Microorganisms, "Estuarine sediments, Acridine orange direct counts, Sediments, Bacterial number, Organic carbon, Biomass, Adenosine triphosphate, Chlorophyll a, Benthos, Algae, Fungi, Protozoans, Salt marshes.

Acridine orange direct counts (AODC) are a useful tool for assessing bacterial numbers in fine-grained marsh and estuarine sediments. The number of bacteria in marshes ranges from 1 - 2 billion cella/cu cm in surface sediments and decreases to 1 - 3 billion cells/cu cm at a depth of 20 cm Most cells are associated with sediment particular to the complex of the county of the cou creases to 1 - 3 billion cells/cu cm at a depth of 20 cm. Most cells are associated with sediment particles and there is a strong correlation of bacterial number with sediment organic carbon content. The average cell volume of sediment bacteria is about 0.2 cu micrometers (range <0.05 to > 2.0 cu micrometers). Estimated bacterial biomass in the micrometers). Estimated bacierial biomass in the upper 20 cm of marsh sediments is in the range of 10 - 20 g carbon/sq m. Total microbial biomass as estimated from adenosine triphosphate (ATP) measurement is in the range of 13 - 32 g carbon/sq m to a depth of 20 cm. Benthic algal biomass (estimated from chlorophyll a) is extremely variable in marsh sediments, but constitutes the major microbial biomass component in surface sediments (0 - 1 cm). Fungi, protozoans, and meiofauna are also important in surface sediments. Microbial biomass and diversity decrease with depth and, below also important in surface sediments. Microbial bio-mass and diversity decrease with depth and, below the surface few centimeters, bacteria comprise the dominant proportion of the total microbial commu-nity. (See also W87-00005) (Author's abstract) W87-00015

NITROGEN CYCLING AND ESTUARINE INTERFACES: SOME CURRENT CONCEPTS AND RESEARCH DIRECTIONS, Maryland Univ., Cambridge. Horn Point Environal Labs.

mental Labs.

W. M. Kemp, R. L. Wetzel, W. R. Boynton, C. F.
D'Ella, and J. C. Stevenson.

IN: Estuarine Comparisons, 1982. Proceedings of
the Sixth Biennial International Estuarine Research
Conference, Gleneden Beach, Oregon, November
1-6, 1981. p. 209-230, 9 fig. 73 ref. EPA Grant Nos.
R805932010 and R805974.

Descriptors: *Nitrogen cycling, *Estuarine interfaces, *Research priorities, Uptake, Regeneration, Desitrification, Nitrification, Water mass fronts, Watershod-estuarine boundaries, Stratified estu-

aries, Sediment-water boundaries, Redox discontinuity layer, Phytoplankton production, Pycno-

The role of physical interfaces in estuarine nitro-gen (N) dynamics is discussed. Four N-transforma-tion processes (uptake, regeneration, denitrifica-tion, nitrification) and five interfaces (water mass tion, nitrification) and five interfaces (water mass fronts and transitions, watershed-estuarine boundaries, the pycnocline of stratified estuaries, the sediment-water boundary, the redox discontinuity layer) are considered. It is shown that phytoplation production and, in turn, NH4(+) recycling can be simulated at interfaces where two water masses meet, with one being relatively clear and the other nutrient-rich. Data are provided to illustrate that N recycling rates tend to exceed (by 2 - 8 fold) inputs of 'new' N entering across watershed-estuary boundaries, although annual net primary production is more a function of the latter. It is argued that periodic occurences of high NO2(-) concentrations in strongly stratified water columns reflect active NH4(+) oxidation at the estuarine pycnocline. Evidence is given to indicate that intensive trations in strongly stratined water columns reflect active NH4(+) oxidation at the estuarine pycnocline. Evidence is given to indicate that intensive remineralization of NH4(+) occurs in the uppermost flocculent layer of sediments, and that fluxes estimated from diagenic modeling would tend to overlook this. Denitification, which is concentrated near the sediment redox discontinuity layer (RDL), may be a major component of estuarine N budgets (\$0 - 60% of NH4(+) recycling). It is indicated that denitrification can be fueled either by sediment nitrification just above the RDL or via NO3(-) diffusion from overlying waters. Recent experimental results are considered to demonstrate the effects of macrophytic roots enhancing nitrification (and possibly denitrification) by transporting O2 and deepening the oxidized zone of sediments. Some generic properties of estuarine interfaces are proposed which may account for their importance in N cycling. (See also W87-0005) (Lantz-PTT) W87-00016 W87-00016

SOIL DYNAMICS AND THE PRODUCTIVITY OF SPARTINA ALTERNIFLORA, Georgia Univ., Sapelo Island. Marine Inst. For primary bibliographic entry see Field 2G. W87-00017

SEDIMENTATION, NUTRIENT ACCUMULA-TION, AND EARLY DIAGENESIS IN LOUISI-ANA BARATARIA BASIN COASTAL

Louisiana State Univ., Baton Rouge. Center for

Louisiana State Univ., Baton Rouge. Center to Wetland Resources.
R. S. Hatton, W. H. Patrick, and R. D. DeLaune.
IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 255-267, 1 fig. 4 tab, 35 ref.

Descriptors: "Sedimentation, "Nutrient accumula-tion, "Barataria Basin, "Louisiana, "Coastal marshes, Nutrients, Cesium radioisotopes, Radioac-tive tracers, Chemical analysis, Soil tests, Salt marshes, Organic carbon, Nitrogen, Iron, Manga-nese, Phosphorus.

Vertical marsh accretion, along with sediment and nutrient accumulation, were examined using 137-Cs dating and chemical analysis of soil cores taken from various marshes in Louisiana's Barstaria Basin. Vertical accretion averaged 1.3 cm/yr and 0.7 cm/yr in levee and backmarsh areas respectively. Inorganic sedimentation increased fourfold from freshwater through salt marshes along a transect perpendicular to the Gulf Coast. The accretionary role of inorganic sediments is variable account. sect perpendicular to the Gulf Coast. The accre-tionary role of inorganic sediments is variable ac-cording to marsh type. Mineral sediment being deposited in the marsh is the principle source of iron, manganese, and phosphorus, but not of or-ganic carbon or nitrogen. Manganese and phosphor-rus appear to be subject to substantial post-deposi-tional remobilization. (See also W87-00005) (Au-thor's abstract)

ECOLOGICAL IMPLICATIONS OF THE VER-TICAL DISTRIBUTION OF MEIOFAUNA IN SALT MARSH SEDIMENTS,

Louisiana State Univ., Baton Rouge. Coastal Ecology Lab.

B. Sikora, and J. P. Sikora.

w. D. Sistora, and J. P. Sikora. IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 269-282, 2 fig, 88 ref. NOAA Grant NA81AA-D-00103.

Descriptors: *Ecological effects, *Meiofauna, *Salt marshes, *Sediments, *Vertical distribution, Nematodes, Anaerobic sediments, Spartina alterniflora, Energy transfer, Carbon cycle, Pelagic food web.

The ecological implications of the vertical distribu-tion of nematodes in anaerobic salt marsh sedi-ments were examined. High belowground produc-tivity of Spartina alterniflora results in a high detri-tal component in the anaerobic marsh soils. Nema-todes are evolutionary adapted to these anaerobic soils and important in the transfer of energy path-way in anaerobic sediments, however, is not the same as the carbon cycle in aerobic sediments. A new concert of energy nathways involving nemanew concept of energy pathways involving nema-todes is presented, which links the aerobic and anaerobic components of the marsh ecosystem Export from the marsh which links the S. alterniflora marsh with the pelagic food web is disc (See also W87-00005) (Author's abstract) W87-00019

INFLUENCE OF FIDDLER CRAB BURROWS AND BURROWING ON METABOLIC PROC-ESSES IN SALT MARSH SEDIMENTS,

Florida Univ., Gainesville. Dept. of Environs Engineering Sciences. Engineering Sci C. L. Montague

C. L. Montague.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 283-301, 5 fig. 2 tab, 52 ref. NSF Grants OCE 75-20842 and DEB 77-20359.

Descriptors: "Fiddler crabs, "Animal behavior, "Metabolic processes, "Salt marshes, "Sediments, Sapelo Island, Georgia, Animal wastes, Organic carbon, Carbon dioxide, Sediment respiration, Oxygen, Ammonia, Spartina alterniflora.

Oxygen, Ammonia, Spartina alternillora.

Effects of burrows and burrowing by fiddler crabs on production and decomposition of organic carbon in a salt marsh on Sapelo Island, GA, were measured. Field experiments determined rate of organic carbon from belowground; efflux of carbon dioxide from burrows; effect of burrows on growth of Spartina alternillora; density of roots near burrows; and salinity, pH, phosphate concentration, and ammonium concentration in burrow water. Fiddler crabs transported 26 g C/sq m from belowground in July 1979. Annual excavation was estimated at 157 g C/sq m, or 20% of the belowground production of S. alternillora. Mean burrow respiration was 2.1 mg COZ/h, accounting for 20% to 90% of salt marsh sediment respiration, depending on marsh wetness. Burrows increased S. alternillora standing stocks by 23% in high marsh. Chemistry of burrow water was much different from interstitial water. Salinity of burrow water was 37 - 45%. Burrows also contained high levels of ammonium. The combined effects of added nutrients, lower salinity, greater oxygen, lower sulfide, and greater flow of water through sediments as a result density as a result of the combined of the contribution of the combined effects of added nutrients, lower salinity, greater oxygen, lower sulfide, and greater flow of water through sediments as a result of the combined and creater flow of water through sediments as a result of the combined and combined and combined as a result of the combined and combined monum. The combined effects of added nutrients, lower sulfide, and greater flow of water through sediments as a result of fiddler crab burrowing are suggested as reasons for the increased standing stock of short S. alterniflora. (See also W87-00005) (Author's abstract)

EMISSIONS OF SULFUR GASES TO THE AT-MOSPHERE FROM ESTUARIES AND COAST-AL AREAS,

Drexel Univ., Philadelphia, PA. Dept. of Chemis-

A. R. Bandy, P. J. Maroulis, B. Bonsang, and C. A. Brown.

Brown.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 303-312, 6 fig. 1 tab, 19 ref.

Estuaries—Group 2L

Descriptors: *Sulfur gases, *Atmosphere, *Estuaries, *Coastal marshes, Carbon disulfide, Sulfur dioxide, Bays, Carbonyl sulfide, Sulfur compounds, Air pollution.

Based on recent measurements of the atmospheric concentrations and predicted chemistry of the most abundant atmospheric sulfur gases, an hypothesis is put forward that carbon disulfide (CS2) is the primary precursor of background sulfur dioxide (SO2). Preliminary measurements indicating that bay and coastal waters were greatly superasturated with CS2 are presented to support this hypothesis. The coastal and bay water samples also were supersaturated with respect to carbonyl sulfide (OCS). These results are the basis for another hypothesis that the oceans were supersaturated with OCS and thus are an important if not dominant source of this material. A volatile sulfur compound, yet unidentified, was also found in large amounts in the water samples analyzed. Some speculation is presented as to the identity of this compound. (See also W87-00005) (Author's abstract) stract) W87-00021

STATUS OF ANADROMOUS FISHES IN SOUTHEASTERN U.S. ESTUARIES, Unity Coll., Mc. Center of Environmental Studies. R. A. Rufilson, M. T. Huish, and R. W. Thoesen. IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 413-425, 1 fig. 3 tab, 2 ref.

Descriptors: *Anadromous fish, *Estuaries, *United States, Sturgeon, Striped bass, Shad, Alewife, Blueback herring, Water pollution effects, Water resources development, Reservoirs, Dams, Industrial wastewater. Spawning, Fish hatcheries.

Population status of 11 species of races of anadromous fish was assessed for 85 riverine areas in seven Southern coastal States by asking State, Federal and other agencies to respond to a questionnaire developed for the U.S. Fish and Wildlife Service 'Anadromous Species Management Plan for the Southeast.' Atlantic and shortnose sturgeons, striped bass, Atlantic race), American and hickory shads, alewife, and blueback herring utilize Southeast Atlantic coast estuaries as spawning grounds or nursery areas. Atlantic sturgeon (Gulf race), striped bass (Gulf race), Alabama shad, and skipjack herring utilize estuaries along the Gulf of Mexico. Some of these populations appear to be stable, but many are declining or threatened and several have been extirpated. Atlantic races of striped bass have been introduced into Gulf coastal waters, and some populations along both coasts are increasing due to years of restocking and restoration efforts. Questionnaire responses suggest that overfishing, poor water quality, low oxygen levels, location of industrial discharges, chemical pollution, dams and impoundments, and inadequate fishway facilities have reduced spawning habitat and nursery areas in many river systems, contributing to the decline of anadromous stocks in Southeastern U.S. waters. (See also W87-00005) (Author's abstract) W87-00022 W87-00022

FACTORS AFFECTING RECRUITMENT OF POTOMAC RIVER STRIPED BASS AND RESULTING IMPLICATIONS FOR MANAGE-

MENT, Martin Marietta Corp., Baltimore, MD. Environ-

T. T. Polgar. 11. 1. Foigar.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 427-442, 1 fig. 31 ref.

Descriptors: *Estuaries, *Striped bass, *Potomac River, *Fisheries, *Fish management, Fish conser-vation, Morone saxatilis, Fish population, Plank-ton, Environment, Fish harvest, Ecological effects, Ecological distribution.

Studies of the Potomac River estuary's striped bass (Morone saxatilis Walbaum) population have

ahown that year-class strengths are largely determined by density-independent environmental factors. The level of recruitment of mature adults into the estuary's fishery follows trends in year-class strength and is also modified by fluctuations in fishing effort in and out of the estuary. Ichthyoplankton distributions, together with information on environmental variability, provide a basis for determining year-class strength prior to the juvenile stage. Feeding habits of larvae and juveniles and food availability are important links between abiotic environmental factors and eventual year-class strength. Given the resulting dominant-year-class nature of the population (resource), in which excess, harvestable production is provided by the occasionally successful year-class, management should focus on conserving yields from large cohorts. This analysis demonstrates that this strategy would increase yields over time because it increases net biomass by lowering mortalities during the early phases of recruitment. (See also W87-00003) (Author's abstract)

ESTUARINE LARVAL RETENTION MECHANISMS ON TWO SCALES,
Johns Hopkins Univ., Shady Side, MD. Chesapeake Bay Inst.
W. C. Boicourt.
IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 445-457, 6 fig. 15 ref.

Descriptors: *Estuaries, *Larvae, Tidal effects, Tidal currents, Spatial distribution, Temporal distribution, Oysters, Blue crab, Choptank River, Chesapeake Bay, Tides, Ecological effects, Ecological distribution.

effects, Ecological distribution.

Circulation processes can explain the observational evidence of estuarine larval retention, but knowledge of water motion is required on the small spatial and temporal scales appropriate to larval transport. Two cases are presented - the oyster Crassostrea virginica and the blue crab Callinectes sapidus - in which the operative mechanism is recruitment or return rather than retention in the strict sense. In the case of the oyster, marked differences in spat settlement success between two adjacent tributaries in the lower Choptank River (Chesapeake Bay) are explained by subtle differences in the exchange mechanisms between the tributaries and the lower Choptank proper. In the case of the blue crab, the return of later stage larvae to Chesapeake Bay from the continental shelf can be provided by the northward flowing inner shelf band which is driven by the wind against the prevailing southward flow. (See also W87-00024)

TIMING OF LARVAL PRODUCTION AND FLUX OF INVERTEBRATE LARVAE IN A WELL-MIXED ESTUARY, South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. J. H. Christy, and S. E. Stancyk.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 489-503, 2 fig. 3 tab, 43 ref. NSF Grant Nos. DEB 8004275 and OCE 77-20960.

Descriptors: *Distribution patterns, *Crabs, *Larvae, *Estuaries, North Inlet, South Carolina, Scological distribution, Invertebrate larvae, Fluctuations, Tidal effects, Tidal currents, Larval dentered in the control of the control

Flux of invertebrate larvae between an estuary and coastal waters and the effect of the timing of larval production by estuarine crabs on larval transport were studied in North Inlet estuary, South Carolina. Invertebrate larvae were sampled from three transects across the entrances to this well-mixed estuary during spring and neap tidal periods in each season in 1979. Crab zoeae also were sampled nightly throught the summer at a single station in the upper reaches of the estuary. The net flux of most larval groups corresponded to the net flux of

water and was not different from zero. Six of the 20 larval groups sampled (e.g. echinoderm plutei, barnacle cyprida) showed significant imports to the estuary during one or more sampling periods. Only crab zoeae were exported significantly from the estuary. Such exports occurred during spring tidal periods in the summer when the densities of stage I zoeae of the seven dominant estuarine species were 6 to 57 times greater in the lower estuary and 100 to 10,000 times greater in the upper estuary than during neap tidal periods. Maximum zoeal densities occurred when female crabs released larvae. The timing of larval release may result in rapid seaward transport of newly hatched zoeae on nocturnal ebb tides of greatest amplitude during the semilunar cycle, leading to significant net export from the estuary. (See also W87-0005) (Author's abstract) W87-00025

TIDALLY TIMED BEHAVIOR; EFFECTS ON LARVAL DISTRIBUTIONS IN ESTUARIES. Yale Univ., New Haven, CT. Dept. of Biology. T. W. Cronin, and R. B. Forward. 11. W. Cronin, and R. B. Forward.
11. W. Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 505-520, 7 fig. 2 tab, 37 ref. NSF Grant Nos. OCE 77-26838 and OCE 8007434.

Descriptors: *Tidal effects, *Larvae, *Distribution patterns, *Estuaries, Crabs, Newport River, North Carolina, Migrataions, Time series analysis, Mathematical studies, Tides, Salinity, Plankton, Ecological distribution, Ecological effects.

Zoeal larvae of the xanthid crab Rhithropanopeus harrisii are retained in the upper regions of the Newport River estuary, North Carolina. This retention is effected by rhythmic vertical migrations which are similar for all zoeal stages, ranging above and below the depth of no net flow. Time series analysis of these migrations revealed that their dominant periodic components were usually those of the tidal cycle (period = 12.4 h) and the current flow cycle (period = 6.2 h). Under constant laboratory conditions, larvae taken directly from the estuary continued only the tidal vertical migration, reaching their greatest depth at the time of low tide. In contrast, larvae reared in the laboratory under a 12 h:12 h light:dark cycle had only a weak circadian migration rhythm. The tidal rhythm is also expressed in larvae tested immediately after hatching from Newport River crabs, but the migration amplitude is greater for larvae which have spent at least one day under field conditions. Time of hatching may also play a part in setting the phase of this rhythm. Larvae are released near the time of local high tide; this timing is evidently adapted to take advantage of maximum salinity of the water and to help determine the region of the estuary in which they will subsequently develop. Tidal behavior and tidal rhythms could be widespread among estuarine zooplankton, particularly in regions where the tides exert strong dynamic effects on the physical structure of estuarine waters. (See also W87-00005) (Author's abstract) W87-00026

TIME DEPENDENT PROPERTIES OF COHE-SIVE SEDIMENT RELEVANT TO SEDIMEN-TATION MANAGEMENT: EUROPEAN EXPE-RIENCE.

of Oceanographic Sciences, Taunton Institute (England). For primary bibliographic entry see Field 2J. W87-00027

RESUSPENSION POTENTIAL OF DEPOSIT-ED COHESIVE SEDIMENT BEDS,

Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
A. J. Mehta, T. M. Parchure, J. G. Dixit, and R. Ariathurai.

Ariatura.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleenden Beach, Oregon, November 1-6, 1981. p 591-609, 12 fig. 27 ref. EPA Grant R80668410, NSF Grant GK-31259.

Group 2L—Estuaries

Descriptors: *Resuspension potential, *Cohesive sediments, *Estuaries, Model studies, Sediment transport, Fine sediments, Kaolinite, Experimental data, Experimental design, Suspension, Shear

stress, Erosion.

Surficial layers of fine, cohesive sediment beds in estuaries typically consist of partially consolidated sediments deposited from flow. Such layers tend to have a high water content and exhibit a non-uniform variation of the shear strength with depth. Predictive modeling of estuarial fine sediment transport requires an appropriate description of the erosive behavior of deposited beds. Most available descriptions however are based on laboratory tests using mechanically placed beds. Such beds possess relatively uniform properties and are representative of settled, consolidated estuarial beds. A laboratory test methodology for investigating the resuspension potential of deposited beds is described. Tests using beds of kaolinite show that the rate of reosion varies exponentially with the excess bed shear stress. The influence of bed consolidation time and water chemistry on the rate and the critical shear stress for erosion has been investigated. The derived expression for the rate of erosion can be suitably incorporated in the resuspension routines for estuarial fine sediment transport models. (See also W87-00005) (Author's abstract) W87-00028

SEDIMENTATION ASSOCIATED WITH TIDAL BARRIERS IN CHINA'S ESTUARIES AND MEASURES FOR ITS REDUCTION, Nanjing Hydrological Research Inst. (China). L. Zhaosen, and G. Peiyu.
IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 611-622, 3 fig. 1 tab, 5 ref.

Descriptors: *Sedimentation, *Tidal barriers, *China, *Estuaries, *Sediment control, Hydraulic sluices, Stuices, Agitation dredging, Dredging, Tidal flushing, Flushing, Baihai Bay, Sluice gates.

The severity of sedimentation in estuaries with tidal barriers in China is described and explained in light of changes in hydraulic conditions associated with tidal barrier construction (such as decreased in river flow and tidal flow and deformation of tidal with tidal barrier construction (such as decreases in river flow and tidal flow and deformation of tidal waves). The various measures for sitation-reduction discussed are: 1) Hydraulic sluicing which uses water energy effectively in a simple, effective operation. Together with mechanical agitation it becomes more efficient; 2) Agitation dredging which is highly adoptable; the finer the deposited sediment the better. The magnitude of the threshold velocity of a sediment grain on the riverbed is inversely proportional to sediment grain size when list diameter of sub 50 < 0.2 mm. At the same time, fine silt is more difficult to remove when it is compacted; however, fine sediment can be carried further at the same velocity once it is resuspended. In accordance with China's experience, this method is efficient when sediment grain of sub 50 < 0.1 mm. Below tidal barriers in Baihai Bay (Hepei Province), deposited sediment suspended by mechanical agitation can be moved by ebb tide flow and run to the sea when D sub 50 = 0.003 mm. In deeper water (e.g. h > 3 m), more efficiency is achieved with serated-type rakes. This tool can also be used for deepening the bar draft of an estuary easily and conveniently. It is sometimes cheaper than dredging, However, it is a complicated problem to grasp the opportune time to remove river sediment as to money and time; and 3) Tidal flushing, by enlarging the tidal prism requires construction of another gate, more expense, and complicated control. However, it uses tidal energy instead of mechanical energy. Each specific method has advantages and disadvantages that make it location-specific. (See also W87-00005)

SEDIMENT CONTROL THROUGH DREDG-Corps of Engineers, Atlanta, GA.
For primary bibliographic entry see Field 8C. For primary W87-00030

CHANG JIANG (YANGTZE) ESTUARY: ESTABLISHING ITS PLACE IN THE COMMUNI-

TABLISHING ITS PLACE IN THE COMMUNI-TY OF ESTUARIES, State Univ. of New York at Stony Brook. Marine Sciences Research Center. J. R. Schubel, and D. J. Hirschberg. IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 649-654, 5 tab, 2 ref.

Descriptors: *Chang Jiang River, *Yangtze River, *Estuaries, China, Saline water, Sea level, Ecosystems, River basins, River discharge, Comparison studies, Suspended sediments.

Among the World's rivers, the Chang Jiang (Yangtze) ranks fourth in length; fifth in average water discharge at its mouth; and fourth in suspended sediment discharge. Its ranking among the World's community of estuaries is less secure. Like the World's other estuaries, the Chang Jiang estuary was formed by the most recent rise of sea level. Because of its large sediment discharge, the estuary has been largely filled. The sea is being expelled at a rate of nearly 40 m/yr. During the summer period of high river discharge, the water of the estuary is completely replaced by freshwater. At other times of the year, the head of salt water interface extends inland only a few tens of kilometers. The estuary of the Chang Jiang not only is being driven seaward, but is being constricted at its mouth, and is migrating south. The remaining life span of the Chang Jiang estuary is short. (See also W87-00031) (Author's abstract)

MODEL OF DEVELOPMENT OF THE CHANG JIANG ESTUARY DURING THE LAST 2000

YEARS, East China Normal Univ., Shanghai. Inst. of Estua-

East China Normal Univ., Shanghai. Inst. of Estua-rine and Coastal Research.

J.-Y. Chen, C.-X. Yun, and H. Xu.
IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 655-666, 7 fig. 8 ref.

Descriptors: *Model studies, *Chang Jiang River, *Estuaries, China, History, Shoals, Channels, Dredging, Theoretical analysis, Hydrologic

The establishment of a model of estuarine development can have great significance both in theory and in practical application. Such a model reveals the basic pattern of estuarine development and consequently provides a theoretical basis for predicting the developmental tendency of an estuary and a reliable scientific base for effective management of that estuary. Since it is the outlet of the longest river in China, the Chang Jiang estuary has evolved in a relatively complicated manner. Consequently, a summary of its evolutionary history for the establishment of its developmental model may have significant value for managing the estuary. This paper, based on field observations, hydrological surveys and historical literature, outlines the development of the Chang Jiang Estuary during the last 2000 years. The sequence of major events in its development may be summarized as follows: (1) gradual growth of shoals near the south bank; (2) attachment of shoals and islands to the north bank; (3) narrowing of the estuarine each; (4) formation of normal channel, and (5) deepening of the channel. Such a developmental model is of simiference in extractive extractive extractives. The establishment of a model of estuarine developdeepening of the channel. Such a developmental model is of significance in estuarine theory, as well as for the practice of estuarine management. (See also W87-00005) (Lantz-PTT)

DESCRIPTIONS OF THE MORPHOLOGY AND SEDIMENTARY STRUCTURES OF THE RIVER MOUTH BAR IN THE CHANG JIANG

ESTUARY, East China Normal Univ., Shanghai. Inst. of Estua-rine and Coastal Research. J.-Y. Chen, S.-Z. Zhu, Q.-R. Lu, Y. Zhou, and S.

He. IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research

Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 667-675, 10 fig, 3 ref.

Descriptors: *Morphology, *Sedimentary struc-tures, *Rivers, *Bars, *Chang Jiang River, *Estu-aries, Channels, Flood channels, Ebb channels, Sedimentation, Alluvial fans, Deltas.

The river mouth bar at the Chang Jiang Estuary has depths of less than 10 m over a broad area that extends across the estuary and out over the inner continental shelf. Flood and ebb channels are usucontinental shelf. Flood and ebb channels are usually separate, with shallower areas between them. Over the past 100 years the 5 m contour has progressed seaward 5 - 12 km and the 10 m contour up to 14 km seaward (opposite the South Channel). The Heng Sha has migrated 5 km upstream and been brought under cultivation during that period, although there has been little change at the central core of the bar. Only about a 2 m change in channel depth (from 5 to 7 m) has occurred. The bar is a part of and rests upon the Chang Jiang delta and cores bored into the bar reveal the longer-term history of the delta. Changing sediment characteristics and flux in the estuary have been recorded, as well as the changing form of the delta itself. (See also W87-00005) (Author's abstract)

CIRCULATION OF THE CHANG JIANG ESTU-ARY AND ITS EFFECT ON THE TRANSPORT OF SUSPENDED SEDIMENT, East China Normal Univ., Shanghai. Inst. of Estua-rine and Coastal Research.

rine and Coastal Research.

H. -T. Shen, H. -F. Zhu, and Z. -C. Mao.

IN: Estuarine Comparisons, 1982. Proceedings of
the Sixth Biennial International Estuarine Research
Conference, Gleneden Beach, Oregon, November
1-6, 1981. p 677-691, 10 fig, 6 ref.

Descriptors: *Chang Jiang River, *Estuaries, *Water circulation, *Sediment transport, *Suspended sediments, Channel improvement, Hydrology, Oceanography, Sedimentology, Stratification, Mixing, Freshwater runoff, Tidal currents.

Organizations responsible for the maintenance of navigation channels in the Chang Jiang estuary, and other organizations concerned with estuarine and other organizations concerned with estuarine processes, have made hydrological, oceanographic, and sedimentological observations in the Chang Jiang estuary since the 1960's. These measurements are summarized in this paper and used to characterize mixing processes and salinity patterns from which circulation patterns and their effect on the transport of suspended sediment are inferred. It is shown that the Chang Jiang estuary is characterwhich circulation patterns and their effect on the transport of suspended sediment are inferred. It is shown that the Chang Jiang estuary is characterized by large fresh water runoff, abundant suspended sediments, and large intertidal volumes, all of which vary seasonally. As a result, stratification varies from place to place and time to time, ranging from well mixed to partially mixed. Fresh water runoff and tidal currents are shown to be the two most decisive factors in the formation of turbidity maxima, fluid mud layers, and the channel sand bars and their variations. (See also W87-00005) (Author's abstract) 00005) (Author's abstract)

STUDY OF DIFFUSION OF UPPER-LAYER SUSPENDED SEDIMENTS IN DISCHARGES FROM THE CHANG JIANG ESTUARY INTO THE SEA, BASED ON SATELLITE IMAGERY, East China Normal Univ., Shanghai. Inst. of Estuarine and Coastal Research. -X. Yun, and J. -R. Wan.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 693-704, 3 fig. 2 tab, 6 photos, 6 ref.

Descriptors: *Diffusion, *Suspended sediments, *Discharge measurement, *Chang Jiang River, *Estuaries, *Satellite imagery, Sediment distribution, Turbulent diffusion, Channel improvement, Harbors.

The Chang Jiang River with its enormous discharge of water and huge quantity of suspended

Estuaries—Group 2L

sediments influences the estuary as well as the natural environment of the adjacent offshore regions. This paper analyzes the distribution, diffusion, and deposition of suspended sediments in the Chang Jiang estuary and in adjacent shelf areas as determined by satellite imagery. These data have important implications for construction and maintenance of navigation channels and harbors, and for utilizing and developing beach resources and aquatic resources. Good agreement of results of computer simulations based on satellite imagery with sea-truth data support the methodology used in this study. (See also WRT-00003) (Author's abwith sea-truth data support the methodology used in this study. (See also W87-00005) (Author's ab-

STEADY AND NON-STEADY FLOW MODELS FOR SIMULATION OF WATER QUALITY IN RIVERS.

Instituto de Pesquisas Hidraulicas, Porto Alegre (Brazil).

For primary bibliographic entry see Field 5B. W87-00147

ONE-DIMENSIONAL MODEL FOR SALINITY INTRUSION IN ALLUVIAL ESTUARIES, Euroconsult, Arnhem (Netherlands). H. H. G. Savenije. Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 87-109, June 15, 1986. 17 fig, 2 tab, 6 ref.

Descriptors: *Saline water intrusion, *Model studies, *Estuaries, Alluvial estuaries, Mathematical analysis, Statistical analysis, Salinity.

A salinity intrusion model for well-mixed alluvial estuaries is developed. The parameters are schematized in such a way that the amount of field work in gathering data on estuary geometry and tide is considerably reduced. The determining factor in the geometry is found to be the variation of width in gauering data on estuary geometry and that is considerably reduced. The determining factor in the geometry is found to be the variation of width in the estuary. This relationship appears to obey an exponential law. The depth is found to remain fairly constant and does not necessarily have to be measured. The model makes use of a set of simplifications, which through the application in a salmity intrusion model, have been shown to be justified. In models where non-linear phenomena play an important role e.g. morphological models to explain the shape of an alluvial estuary, these simplifications would probably not be valid. For the salinity intrusion model, however, the linear case may be considered and it has been shown that the physical laws are not violated by the schematizing process. Considering that the model has been applied in several quite different alluvial estuaries, it can be concluded that the use of these simplifications in a salmity intrusion model is justified. Since the depth may be considered a constant and the widths can be measured from a map, the estuary geometry no longer needs to be surveyed. The model therefore is very economical. Although the model has been tested in a wide range of estuaries, it is difficult to be definite about its general applicability. Estuaries all over the world have very different characteristics. At this stage, the model seems applicable to funnel-shaped alluvial estuaries. It is however, apparent that the model will not be applicable when there is no definite funnel-shaped ageometry and when the widths do not obey the exponential law. This implies that the model is not directly applicable to man-made estuaries or natural estuaries where banks are protected or where dredging takes place. (Lantz-PTT)

EFFECTS OF TEMPERATURE, SALINITY, IR-RADIANCE AND DIURNAL PERIODICITY ON GROWTH AND PHOTOSYNTHESIS IN THE DIATOM NITZSCHIA AMERICANA: LIGHT-LIMITED GROWTH,

North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences. For primary bibliographic entry see Field 5C. W87-00165

EFFECT OF SALINITY GRADIENTS AND HE-TEROTROPHIC MICROBIAL ACTIVITY ON BIODEGRADATION OF NITRILOTRIACETIC

ACID IN LABORATORY SIMULATIONS OF THE ESTUARINE ENVIRONMENT, Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab. For primary bibliographic entry see Field 5B. W87-00168

EFFECTS OF ORGANIC AMENDMENTS ON SULFATE REDUCTION ACTIVITY, H2 CON-SUMPTION, AND H2 PRODUCTION IN SALT MARSH SEDIMENTS,

MARSH SEDIMENTS, EmTech Research Corp., Mount Laurel, NJ. H. J. Dicker, and D. W. Smith. Microbial Engineering MCBEBU, Vol. 11, No. 4, p. 299-315, December, 1985. 5 fig. 1 tab, 61 ref. DOC Grant No. NA83AA-D-0017.

Descriptors: *Sulfates, *Sulfur bacteria, *Salt marshes, *Marine sediments, *Hydrogen, Organic compounds, Radioactive tracers, Mineralization, Soil amendments, Biodegradation, Organic matter, Oxidation, Metabolism, Fate of pollutants, Tidal marshes, Microbial degradation, Delaware, Canary

Creek Marsh.

Sulfate reduction activity (SRA) was measured via the radioactive tracer 35-S04(2-) technique in sediment samples from the Canary Creek Marsh in Lewes, Delaware. Basal levels of SRA ranged from 130 to 319 namnoles of sulfate reduced/g dry sediment/hr. With the exception of lactate and formate, all organic acids tested resulted in no stimulation of SRA, whereas straight chain alcohols (C1-C4) all gave a significant increase in SRA. In addition, H2, glucose, and cellobiose caused a twofold or greater increase in SRA, While cellulose amendments did not alter SRA. Molybdate, and inhibitor of sulfate-reducing bacteris (SRB), caused a total inhibition in SRA. 2-Bromoethane-sulfonic acid (BES), an inhibitor of methanogenic bacteria, caused a slight decrease in SRA. Hydrogen was not produced in detectable quantities in unamended samples but was produced in large amounts in glucose-amended samples. Hydrogen was rapidly consumed in unamended samples with molybdate additions causing a significant decrease in the rate of H2 consumption. A variety of organic amendments was found to stimulate H2 uptake. These studies suggest that SRB are simulated by a large variety of organic amendments in in situ and that SRB play a major role in maintaining low partial pressures of H2 in marsh sediments. (Author's abstract) W87-00176

METABOLISM OF LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS BY SULFATE-REDUCING BACTERIA IN A DELAWARE SALT MARSH,

WARE SALT MARSH, EmTech Research Corp., Mount Laurel, NJ. H. J. Dicker, and D. W. Smith. Microbial Ecology MCBEBU, Vol. 11, No. 4, p 317-335, December, 1985. 5 fig., 1 tab, 41 ref. DOC Grant No. NA83AA-D-00017.

Descriptors: *Marine sediments, *Salt marshes, *Oxidation, *Organic compounds, *Sulfur bacteria, Carbon dioxide, Metabolism, Anaerobic conditions, Bottom sediments, Mineralization, Biodegradation, Microbial degradation, Decomposition, Fate of pollutants, Sulfates, Organic matter, Dela-

Oxidation of acetate, lactate, pyruvate, and ethanol to CO2 in anaerobic salt marsh sediments was rapid, with the oxidation rate being significantly inhibited (60-90% decrease) in the presence of 2 mM sodium molybdate, an inhibitor of sulfate-reducing bacteria (SRB). 2-Bromoethanesulfonic acid (BES), an inhibitor of methanogenic bacteria, generally had no effect on the oxidation rate. Aceta was the only intermediate product detected in generally had no effect on the oxidation rate. Accepte was the only intermediate product detected in the oxidation of lactate and ethanol. Competition studies with lactate, acetate, and ethanol indicated that the preferred order of substrate utilization was lactate, then acetate, then ethanol. The turnover times of these three compounds in salt marsh sediments via the combined CO2 plus acetate pool was rapid (10-13 hr) with a two- to threefold increase in the turnover time in the researce of molyhelate. in the turnover time in the presence of molybdate. These results strongly suggest that SRB play a

major role in the terminal metabolism of low mo-lecular weight organic compounds in anaerobic salt marsh sediment. (Author's abstract)

DISTRIBUTION OF BACTERIA ASSOCIATED WITH VARIOUS SIZES OF PARTICULATE MATTER IN HARIMA-NADA AND HIUCHINADA AREAS, SETO INLAND SEA, JAPAN, Kochi Univ. (Japan). Faculty of Agriculture. For primary bibliographic entry see Field 5B. W87-00179

SHORT-TERM PHOTOSYNTHETIC RE-SPONSES IN THE DIATOM NITZCHIA AMERICANA TO A SIMULATED SALINITY ENVIRONMENT, North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences. R. L. Miller, and D. L. Kamykowski. Journal of Phytoplankton Research JPLRD9, Vol. 8, No. 2, p 305-315, March, 1986. 6 fig. 31 ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Salinity, *Diatoms, *Respiration, Estuaries, Salinity currents, Models, Simulation analysis, Primary productivity, Model studies, North Carolina, Cape

The effect of short-term variations in salinity on photosynthesis and respiration in an estuarine clone of the diatom Nitzschia americana was studied by a laboration environmental simulation. clone of the diatom Nitzichia americana was stud-ied by a laboratory environmental simulation system. A computer-controlled culturing system simulated surface longitudinal salinity gradients in the Cape Fear River Estuary by regulating the growth conditions of a continuous culture in real-time. Salinity changes were described by a one-dimensional horizontal advection model of the es-tuary that proved useful in evaluating phytoslestime. Salinity changes were described by a onedimensional horizontal advection model of the estuary that proved useful in evaluating phytoplankton photosynthetic responses to changes in its local
environment on time scales similar to those found
in natural systems. As more sophisticated models
of the physical environment and particle transport
are incorporated into the program, realistic physiclogical models of phytoplankton production can be
developed. Average rates of net carbon fixation
measured during the simulation were compared to
rates predicted by long-term adaption studies. Results indicated that rates of net carbon fixation
declined sharply following a rapid increase in salinity. rates of net carbon fixation return, however,
approximately to really predicted rates if the salinity environment was constant for about 24 hr, suggesting an adaption period. It was concluded that
this time is needed for N. americana to initiate
physiological mechanisms responsible for osmore
gulation and various compensatory responses to
changes in salinity. These results suggest that siginficant errors may result when production models
based on long-term adaptive responses are used to
describe phytoplankton productivity in variable
environments. (Geiger-PTT)
W87-00183

ANALYSIS OF PHOTOSYNTHESIS IN AIR AND WATER OF ASCOPHYLLUM NODOSUM

Dundee Univ. (Scotland). Dept. of Biological Sci-

A.M. Johnston, and J.A. Raven. Oecologia OECOBX, Vol. 69, No. 2, p 288-295, May 1986. 7 fig. 4 tab, 42 ref. SERC Studentship Grant B80311910.

Descriptors: *Photosynthesis, *Temperature, *Carbon, *Light, *Submergence, Michaelis-Menten kinetics, Lineweaver-Burk plots, Woolf plots, Blackman curves, Hill-Whittingham equations, Mathematical models, Limiting factors.

The photosynthetic characteristics of the intertidal The photosynthetic characteristics of the intertidal macroalga Ascophyllum nodosum were examined in air and water. Under ambient conditions of temperature (10 °C) inorganic carbon concentrations (15.63 mmol CO2/cu m or 2.0 mol total inorganic carbon/cu m) and light (500 micromol photons/sq m per sec) photosynthesis was slightly greater by the exposed alga than by the submerged

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alga. In both environments photosynthesis was light saturated at 200 micromol photons/sq m per sec. The relationship between CO2 concentration and photosynthesis in air could be accurately ana-lyzed using Michaelis-Menten kinetics, although lyzed using Michaelis-Menten kinetics, although the range of concentrations used was not saturating. In contrast, the application of the Lineweaver-Burk and Woolf plots to aquatic photosynthesis was not suitable as experimental data was similar to the Blackman type curves and not rectangular hyperbolae. This was reflected by the applicability of the Hill-Whittingham equation to describe the photosynthesis curves. The effect of unstirred layers and other limiting factors is discussed in relation to the kinetic parameters, V sub max and K subm. (Author's abstract)

POPULATION DYNAMICS OF CORBULA TRIGONA (MOLLUSCA) IN LAKE AHEME, A WEST AFRICAN LAGOON IN BENIN, Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.

J-L. Maalin, and Y. Bouvet.

Oikoa, Vol. 46, No. 3, p 292-302, May 1986. 6 fig, 36 ref.

Descriptors: *Mollusks, *Lake Aheme, *Salinity, *Dissolved oxygen, *Seasonal distributions, Benin, Recruitment, Rainy seasons, Dry seasons, Seawater, Lagoons, Africa.

The succession of cohorts of Corbula trigona was investigated in Lake Aheme, Benin, a coastal lagoon subject to large fluctuations in salinity and dissolved oxygen during a yearly cycle. In the north of the lake, in a zone where fresh water flows in and salinity is lowest, continuous recruitment was observed, with a maximum during the rainy season. In the south, recruitment was confined to the rainy season, and a complete interruption of recruitment and even elimination of the population during the dry season was seen. It is during the dry season that salinity reaches its highest level due to the influence of seawater, and oxygen falls to its lowest level in the lake at this time. The use of the Batiacharya method for discriminating cohorts is discussed. (Rochester-PTT) W87-00228

PECULIARITIES OF OSMOTIC AND IONIC REGULATION IN BIVALVE MOLLUSKS WITH REFERENCE TO ENVIORNMENTAL

Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst. A. Y. Komendantov, V. V. Khlebovich, and N. V.

Aladi Soviet Journal of Ecology SJECAH, Vol 16, No. 5, p 286-292, May 1986. 3 fig. 3 tab, 28 ref. Translated from Ekologiya, No. 5, p 39-46, September-October 1985.

Descriptors: *Osmoregulation, *Salinity, *Salt tolerance. *Mollusks, Osmosis.

The osmoregulatory ability of 7 taxa of bivalve mollusks was studied. With the exception of Laternula limicola, all the mollusks were able to maintain the hyperosmotic pressure of the internal environment at low aslimites. The relationship between osmoregulatory abilities and salt tolerance ranges of the mollusks and temperature and ionic composition of the environment was shown. It was demonstrated that, at low salinities, freshwater mollusks maintain a Na ion concentration in the blood at higher and, at high salinities, lower level than in the environment. (Author's abstract) W87-00239

EMISSIONS OF BIOGENIC SULFUR GASES FROM A DANISH ESTUARY, Aarhus Univ. (Denmark). Inst. of Ecology and Genetics. For primary bibliographic entry see Field 5B. W87-00289

DETERMINING CURRENT PROFILES IN OS-CILLATORY FLOWS,

stitute of Oceanographic Sciences, Birkenhead

(England).
A.M. Davies.
Applied Mathematical Modelling, Vol. 9, No. 6, p
419-428, December 1985. 5 fig. 1 tab, 15 ref,

Descriptors: *Current profiles, *Oscillatory flow, *Tides, *Bed-stress eddy, *Viscosity, *Galerkin method, *Hydrodynamic mode, Rotary, Water currents, Tidal rivers.

currents, Tidal rivers.

The time dependency of the linear three-dimensional hydrodynamic equations which describe oscillatory flow was removed by expressing the horizontal components of current in terms of rotary components at a prescribed frequency. By this means two time independent equations were derived which could be readily solved using the Galerkin method, in a manner similar to that developed by the author for steady-state wind-induced flow. The method was used to examine the influence of eddy viscosity on tidal current profiles. Two distinct flow regimes were identified. In one the water depth exceeded the thickness of the bottom stress layer, in the other, water depth was less than the thickness of that layer. The influence of these two depth regimes, and the magnitude and vertical variation of eddy viscosity on tidal current profiles was examined. The possibility of using the method to give tidal profiles from vertically integrated models was discussed. The technique was a powerful method for studying tidal currents in a range of water depths and it yielded a continous representation of current profile and stress through the vertical. It had the significant advantage over analytical methods of being able to include arbitary variations of viscosity. The influence of observed variations in viscosity upon tidal current profiles could be observed. (Khumbatta - PTT)

ACTIVITY MEASUREMENTS OF PLANK-TONIC MICROBIAL AND MICROFOULING COMMUNITIES IN A EUTROPHIC ESTUARY, University of South Florida, St. Petersburg. Dept. For primary bibliographic entry see Field 5A. W87-00304

TRACE METAL CONCENTRATIONS IN MARINE ORGANISMS FROM ST. VINCENT GULF, SOUTH AUSTRALIA, Canberra Coll. of Advanced Education, Belconnen (Australia). Water Research Centre. For primary bibliographic entry see Field 5B. W87-00349

BACTERIAL ABUNDANCE IN RELATION TO SURFACE AREA AND ORGANIC CONTENT OF MARINE SEDIMENTS,

State Univ. of New York at Stony Brook. Dept. of Ecology and Evolution.

Ecology and Evolution.

N. Yamamoto, and G. Lopez.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 90, No. 3, p 209-220, August 1985. 2 fig. 1 tab, 23 ref. NSF Grant No. CCE8025345, EPA Grant No. R809475-01-1, Sigma Xi Grant, and SUNY UAP award.

Descriptors: *Marine sediments, *Bacteria, *Salt marshes, Organic loading, Microcosms, Protein,

Direct measures on surface sediments collected from Flax Pond an intertidal salt marsh on Long Island, N.Y. showed a positive relationship between bacterial abundance and specific surface area of sediment. This is the first direct confirmation that this relationship holds over a wide range of sediment types. A laboratory experiment was conducted to determine the effects of specific surface area, distribution of surface area, and organic particles, kaolin, and spherical glass beads, used singly or in mixtures. Organic loading resulted in substantial enhancement of bacterial colonization. Distribution of surface area controlled by texture, shape, and sorting, had a complex effect, with glass bead sediments generally supporting better colonid sediments generally supporting better coloni-ion than silica particles or kaolin. The effect of

specific area was noted only in restricted comparisons of similarly shaped glass beads. (Khumbatta-PTT) W87-00368

EFFECTS OF ORGANIC ENRICHMENT ON MEIOFAUNAL ABUNDANCE AND COMMUNITY STRUCTURE IN SUBLITTORIAL SOFT

SEDIMENTS,
Institute for Marine Environmental Research,
Plymouth (England).
For primary bibliographic entry see Field 5C.
W87-00369

FLUME DESIGN - A METHODOLOGY FOR EVALUATING MATERIAL FLUXES BETWEEN A VEGETATED SALT MARSH AND THE ADJACENT TIDAL CREEK,

South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. T. Wolaver, G. Whiting, B. Kjerfve, J. Spurrier, and H. McKellar.

Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 91, No. 3, p 281-291, September 1985. 2 tab, 4 fig, 18 ref. NSF Grant DEB

Descriptors: *Salt marshes, *Tidal marshes, *Eco-systems, Ecology, Flumes, Nutrients, Material ex-change, Statistical analysis, Water depth, Marshes, Model studies.

An experimental flume was used as a tool to assess whether a vegetated marsh surface is a source or sink for nutrients via tidal inundation. An initial calibration study (two tidal cycles) was conducted to determine the optimum sampling design and aid in model development for flux calculations. A statistical analysis of the data showed a negligible concentration difference as a function of water depth for most of the constituents analyzed. This coupled with the low tidal velocities over the marsh surface (<1.5 cm/s) suggested that a volumetric model was adequate for calculations of instantaneous discharge and nutrient flux through any station perpendicular to tidal flow. The resultant instantaneous mass flux calculations showed that water discharge was one of the dominant factors controlling the movement of material. A sine-cosine statistical model utilizing the main tidal periodicities was designed to (1) model the instantaneous fluxes, (2) calculate the average net flux of suspended and dissolved materials, and (3) test the hypothesis that the average net flux equals zero versus a two-sided alternative using a standard regression t-test. (Author's abstract) ental flume was used as a tool to ass regression t W87-00370

ANAEROBIC METHANE OXIDATION RATES AT THE SULFATE-METHANE TRANSITION IN MARINE SEDIMENTS FROM KATTEGAT AND SKAGERRAK (DENMARK), Aarhus Univ. (Denmark). Inst. of Ecology and

N. Iversen, and B. B. Jorgensen. Limnology and Oceanography LIOCAH, Vol. 30, No. 5, p 944-955, September 1985. 4 fig, 2 tab, 46 ref. Danish Natural Science Research Council Grant 11-3141.

Descriptors: *Anaerobic conditions, *Marine sediments, Sulfates, Fermentation, *Oxidation, *Methane, Sulfate-methane transition, Sediments, Kattegat, Skagerrak, Denmark.

Concomitant radiotracer measurements were made of in situ rates of sulfate reduction and anaerobic methane oxidation in 2-3-m-long sediment cores. Methane accumulated to high concentrations (>1 millimole CH4)only below the sulfate zone, at 1 m or deeper in the sediment. Sulfate reduction showed a broad maximum below the sediment surface and a smaller, narrow maximum at the sulfate-methane transition. Methane oxidation was low (0.002-0.1 nanomole CH4/cu m/d) throughout the sulfate zone and showed a sharp maximum at the sulfate zone and showed a sharp maximum at the sulfate-methane transition, coinciding with the sulfate reaction maximum. Total anaerobic meth-ane oxidation at two stations was 0.83 and 1.16

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millimol CH4/sq m/d, of which 96% was confined to the sulfate-methane transition. All the methane that was calculated to diffuse up into the sulfate-methane transition was oxidized in this zone. The methane oxidation was equivalent to 10% of the electron donor requirement for the total measured sulfate reduction. A third station showed high sulfate concentrations at all depths sampled and the total methane oxidation was only 0.013 millimol CH4/sq m/d. (Author's abstract) W87-00372

SUSPENSION OF MARINE NEMATODES IN A TURBULENT TIDAL CREEK: SPECIES PAT-

IERNS, South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. R. A. Eskin, and M. A. Palmer. Biological Bulletin, Vol. 169, p 615-623, December 1985. 4 tab, 26 ref. NSF Grants OCE80-07968, OCE83-08114.

Descriptors: *Nematodes, *Tidal creeks, *Turbu-lence, *Sediments, *Estuaries, Species diversity, Aquatic animals, Spatial distribution, Tidal effects.

Nematodes had a mean abundance of hundreds/cu m in an estuarine creek. They were four orders of magnitude less abundant in the water column than in the sediment. The water column nematode assemblage was dominated by three species of Metachromadora which comprised 57% of the suspended nematodes. Other abundant species were Chromadorita aff. minima and Ptycholaimellus pandispiculatus. Number of suspended nematodes were highest during the ebb and flood tides when currents were fastest. The two factors that appear to be most important in determining which species are in the water are the verical distribution and the overall abundance of a species in the sediment. Surficial distributions and high sediment abundance will result in greater representation in the water column. Suspension in the water column and subsequent transport by tidal currents potentially plays a significant role in the local dispersal of certain meiobenthic nematode species. Corollaries to water column dispersal are an improved ability of nematodes in colonizing new habitats, and an interaction between hydrodynamic factors and benthic topography that will affect small-scale spatial distribution. (Alexander-PTT) W87-00392 atodes had a mean abundance of hundreds/cu

DIATOM CHRONOLOGY FOR SEDIMENTS IN A HIGH ACCUMULATION RATE ENVI-RONMENT: RUPERT INLET, BRITISH CO-LUMBIA, Memorial Univ. of Newfoundland, St. John's.

Dept. of Physics.
For primary bibliographic entry see Field 5C.
W87-00400

IODINE AND ARSENIC REDOX SPECIES IN OXYGEN-DEFICIENT ESTUARINE WATERS, Melbourne Univ., Parkville (Australia). Marine

Melbourne Univ., Parkville (Australia). Marine Chemistry Lab. E. C. V. Butler, and J. D. Smith. Australian Journal of Marine and Freshwater Re-search AJMFA4, Vol. 36, No. 3, p 301-309, Sep-tember 1985. 3 fig, 2 tab, 38 ref.

Descriptors: *Iodine, *Arsenic, *Path of pollutants, *Estuaries, *Oxygen deficit, Saline water, dissolved oxygen, Fate of pollutants, Distribution analysis, Yarra River, Australia.

The distribution of the redox species of iodine and arsenic in two isolated pools of seawater underlying river water in deep holes in the estuary of the Yarra River is described. In the river water, the dominant species are iodide and As(V). In the saline water of these holes, there are levels of iodine and arsenic greater than an assent in the saline water of these holes, there are levels of iodine and arsenic greater than are present in the original seawater. The subhalocline waters contained <0.22 ml/l of dissolved oxygen, and the redox poise was intermediate between oxic and anoxic conditions. Most of the iodate originally in the seawater was reduced to iodide, but As(III) and As(V) coexisted. It appears that iodine and arsenic entered the water from the anoxic sediment. (Author's abstract)

W87-00429

WINTER ICE REGIME IN THE TIDAL ESTU-ARIES OF THE NORTHEASTERN PORTION OF THE BAY OF FUNDY, NEW BRUNSWICK, New Brunswick Univ., Fredericton. Dept. of Civil

New brunswick Court, 18 Pray.
C. Desplanque, and D. I. Bray.
Canadian Journal of Civil Engineering CJCEB, Vol. 13, No. 2, p 130-139, April 1986. 11 fig, 1 tab,

Descriptors: *Estuaries, *Ice, *Civil engineering, Winter ice, Tidal estuaries, Bay of Fundy, New Brunswick, Ice walls, Ice buildups.

A classification system for the ice regime of well-mixed estuaries with a large tidal range identifies five distinct zones within the estuary by considering the primary ice-related processes in such estuaries. The worst case for the formation of ice accumulations in these estuaries is considered to be that associated with a sequence of freezing temperatures occurring when the difference between the neap tide and the subsequent spring tide is largest. During this period, significant vertical ice walls can form in a few days. The ice walls that form in the upper portion of the estuaries of the Memramcook River and the Petitcodiac River can reach a height of about five meters. As the vertical ice walls are formed they significantly reduce the normal trapezoidal cross section, which has side slopes in the order of 10.0V3.5H, to a rectangular cross section having about the same bottom width. (Author's abstract) W87-00440

FACTORS CONTROLLING THE CONCENTRATIONS OF SOLUBLE PHOSPHORUS IN THE MISSISSIPPI ESTUARY, Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics. For primary bibliographic entry see Field 5B. W87-00478

INORGANIC AND ORGANIC SULFUR CYCLING IN SALT-MARSH PORE WATERS, Kean Coll. of New Jersey, Union. Dept. of Chem istry-Physics. G. W. Luther III, T. M. Church, J. R. Scudlark,

and M. Cosman

Science SCIEAS, Vol. 232, No. 4751, p 746-749, May 9, 1986. 3 fig. 28 ref. NSF Grants DEB82-16376, OCE85-17138, OCE84-11-64, OCE85-

Descriptors: "Sulfur, "Organic compounds, "Sulfur cycle, "Inorganic compounds, "Salt marshes, Marshes, Delaware, Great Marsh, Wetlands, Watersheds, Ecosystems, Pore water, Seasonal variation, Chemical analyses.

sonal variation, Chemical analyses.

Sulfur species in pore waters of the Great Marsh, Delaware, were analyzed seasonally by polarographic methods. The species determined (and their concentrations in micromoles per liter) included inorganic sulfides (< or = 3560), polysulfides (< or = 3260), thiosulfate (< or = 104), tetrathionate (< or = 302), organic thiols (< or = 2411), and organic disulfides (< or = 139). Anticipated were bisulfide increases with depth due to sulfate reduction and subsurface sulfate excesses and pH minima, the result of a seasonal redox cycle. Unanticipated was the pervasive presence of thiols (for example, glutathione), particularly during periods of biological production. Salt marshes appear to be unique among marine systems in producing high concentrations of thiols. Polysulfides, thiosulfate, and tetrathionate exhibited seasonal subsurface maxima. These results suggest a dynamic seasonal cycling of sulfur in salt marshes involving abiological and biological reactions dissolved and solid sulfur species. The chemosynthetic turnover of pyrite to organic sulfur is a likely pathway for this sulfur cycling. Thus, material, chemical, and energy cycles in wetlands appear to be optimally synergistic. (Author's abstract) W87-00498

CONTROL OF NA(+) AND K(+) TRANSPORT IN SPERGULARIA MARINA: I. TRANSPIRA-TION EFFECTS, Illinois Univ. at Urbana-Champaign. Dept. of Plant

Biology. nary bibliographic entry see Field 2I. W87-00553

METHOD FOR DETERMINING ENZYMATI-CALLY HYDROLYZABLE PHOSPHATE (EHP) IN NATURAL WATERS,

Warsaw Univ. (Poland). Dept. of Environmental Microbiology. For primary bibliographic entry see Field 5A. W87-00566

FOOD LIMITATION OF A DELAWARE SALT MARSH POPULATION OF MUMMICHOG, FUNDULUS HETEROCLITUS (L.), Delaware Univ., Newark. School of Life and Health Sciences.

Nesiberg, and V. A. Lotrich.
Oecologia OECOBX, Vol. 68, No. 2, p 168-173,
January 1986. 5 fig, 2 tab, 40 ref.

Descriptors: *Salt marshes, *Mummichog, *Fish food, *Fish populations, Canary Creek, Delaware, Estuarine fisheries, Growth, Reproduction, Cages, Mortality, Fish eggs.

Mortality, Fish eggs.

The relationship of the mummichog to its food supply was examined using 8 x 20 meter enclosures under field conditions. The enclosures were stocked with fish at densities ranging from 1/8 to 4 times the natural population density. Growth estimates were made from individually marked fish. Fish enclosed at normal density grew at the same rate as fish from the natural population, indicating that caging had minimal effects on growth rate. When enclosed below normal density, fish had a growth rate 2-3 times higher than that of the natural population. Fish enclosed at 4 x normal density rate than fish enclosed at 4 x normal density rate than fish enclosed at natural density, and no egg production. Food additions to the same type of enclosure at densities ranging from 1/2 to 4 x natural density had a positive effect on growth rates at all densities. Food additions also caused egg production of fish enclosed at the highest density to attain a rate equivalent to that of the natural population. The authors concluded that total food supply may regulate the maximum size of the Canary Creek (Delaware) mummichog population by affecting individual growth rate, mortality rate, and fecundity. (Author's abstract)

CHARACTERIZATION OF BETA-GLUCOSI-DASE ACTIVITY IN INTERTIDAL MARINE SEDIMENTS,

Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.

G. M. King.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 373-380, February 1986. 7 fig. 1 tab, 35 ref. NOAA Sea Grant NA81AA-D-00035.

Descriptors: *Marine sediments, *Organic com-pounds, *Intertidal areas, *Hydrolysis, Sediments, Ecosystems, Beta-glucosidase, Mud flats, Labora-tory methods.

Glycoside derivatives of 4-methylumbelliferone (MUF) were used to characterize the polysaccharidase enzyme systems present in sediments from an intertidal mud flat. The formation of highly fluorescent MUF on hydrolysis of the various glycosides was determined at low substrate concentrations (<1 microM) and with short incubation periods (>5 min). The hydrolysis of MUF-beta-Doglucose in sediments from depth intervals of 0 to 2 cm was insensitive to the presence of oxygen, dissolved sulfide, and iron; magnesium and calcium were stimulatory, however. A temperature optimum was observed at 40 C, a salinity optimum st 3.9% and a pH optimum at 8.5. Rates of hydrolysis were inhibited by the addition of mercuric chloride and sodium azide, but only partially inhibited by

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toluene and the specific beta-glucosidase inhibitor delta-1, 5-gluconolactone. The response to delta-1, 5-gluconolactone suggested that about 50% of the observed hydrolysis of MUF-beta-D-glucoside was due to exo- and endoglucanases. A wide variety of hydrolytic activities was observed, with at least some nonspecificity occurring in the case of MUF-beta-D-fucoside. Depth profiles indicated maximal activity in surface sediments with rapid decline below 2 cm. MUF-glycosides provided a convenient tool for initial analyses of the dynamics and controls of polymer hydrolysis in marine sediments. (Author's abstract)

APPROXIMATION OF SALT-WATER INTER-FACE FLUCTUATION IN AN UNCONFINED FACE FLUCTUATION IN AN UNCONFINED COASTAL AQUIFER, Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Resources Engineering. For primary bibliographic entry see Field 2F. W57-00667

QUANTITATIVE ANALYSIS OF SALTWATER-FRESHWATER RELATIONSHIPS IN GROUNDWATER SYSTEMS-A HISTORICAL Geological Survey, Reston, VA. For primary bibliographic entry see Field 2F. W87-00675

DISTRIBUTION OF NUCULA TURGIDA (BIVALVIA:PROTOBRANCHIA) FROM UBLY ALVIATRUJUBRANC-HIA) FROM DUBLIN BAY, IRELAND, AND THE EFFECT OF SEDIMENT ORGANIC CONTENT, Trinity Coll., Dublin (Ireland). Environmental Sciences Unit. For primary bibliographic entry see Field 5C. W87-00711

BLOOMS OF CYANOBACTERIA ON THE PO-TOMAC RIVER, Purdue Univ., Lafayette, IN. Dept. of Biochemis-For primary bibliographic entry see Field 5C.

EFFECT OF RECIPROCAL TRANSPLANTING BETWEEN EXTREMES OF PLANT ZONES ON MORPHOMETRIC PLASTICITY OF FIVE PLANT SPECIES IN AN OREGON SALT MARSH. ware Univ., Lewes. Coll. of Marine Studies.

Denaware Univ., Lewes. Coll. of Marine Studies.

D. M. Seliskar.

Canadian Journal of Botany CJBOAW, Vol. 63,

No. 12, p 2254-2262, December 1985. 17 fig, 2 tab,

19 ref. EPA Grant R806013010.

Descriptors: "Salt marshes, "Plant morphology, "Ecological distribution, "Oregon, "Transplantation, Plant populations, Aquatic environment, Marshes, Phemology, Soil chemistry, Plasticity.

Reciprocal transplants of each of five salt marsh Reciprocal transplants of each of five salt marsh plant species were made to determine whether differences in morphology and anatomy between plants at the upper and lower distributional limits of each species were fixed or plastic. At the end of one year, Deschampsia cespitosa, Distributional limits of each species were fixed or plastic. At the end of one year, Deschampsia cespitosa, Distributions cata, Grindelia integrifolia, Jaumea carnosa, and Salicornia virginica all demonstrated morphometric plasticity. Environmental variables were measured to look for correlations between morpholigical and anatomical changes and environment ured to look for correlations between morpholigi-cal and anatomical changes and environment. Chemical properties of the transplanted soils of D. spicata and of S. virginica became like those of the surrounding soil, while the properties of soil around G. integrifolia and J. carnosa transplants did not change significantly upon being moved. Soil moisture content was always greatest at the lower elevational site and probably accounts for much of the structural change observed in the reciprocal transplants. For example, the increase in much of the structural cange observed in the reciprocal transplants. For example, the increase in the amount of aerenchymatous tissue in S. virginica plants moved to the lower elevational site was most likely caused by the nearly saturated soil at that location. Measurements of structural plasticity in response to changing environments can be useful

as indicators and in determining the plant's past environment. (Author's abstract) W87-00757

SUBLITTORAL MACROBENTHIC COMMUNITY STRUCTURE OF AN IRISH SEA-LOUGH EFFECT OF DECOMPOSING ACCU-MULATIONS OF SEAWEED, University of East Anglia, Norwich (England). School of Biological Sciences.

School of Diorogona Carlos S. F. Thrush. Journal of Experimental Marine Biology and Ecol-ogy JEMBAM, Vol. 96, No. 3, p 199-212, May 1986. 4 fig, 1 tab, 49 ref.

Descriptors: *Decomposition, *Algae, *Species composition, *Benthic environment, *Sea-Jough, *Littoral environment, Benthic fauna, Aquatic life, Biomass, Polychaetes, Annelids, Ecosystems.

Biomass, Polychaetes, Annelids, Ecosystems.

The deposition and decay of seaweed produces localized changes in sublittoral macrobenthic community structure on the basin floor of a small sealough. Surveys of the abundance of seaweed accumulations revealed about 7 accumulations per 100 sq m, of which many were sufficiently large and stable to cause anoxic patches. A manipulative field experiment was conducted to assess changes in sediment conditions and community structure in areas covered with seaweed, adjacent areas, and clear areas. Sediment pH and Eh were reduced in smothered areas. Differences in the macrobenthic community between the three treatments indicated a rapid increase in the abundance of two polychaetes, Capitella spp. and Malacoceros fuliginosus, and a loss of rare species in disturbed areas. Sixty-nine days after the initiation of the experiment, a similar number of species were found in each treatment, although areas under seawed were still numerically dominated by Capitella spp. These results indicate that patches of decomposing seaweed have an important role in determining the pattern of species distribution and benthic community structure. (Author's abstract)

CONTRIBUTION OF THE POLYCHAETE, NEANTHES JAPONICA (IZUKA), TO THE OXYGEN UPTAKE AND CARBON DIOXIDE PRODUCTION OF AN INTERTIDAL MUDFLAT OF THE NANAKITA RIVER ESTUARY, JAPAN, Tohoku Univ., Sendai (Japan). Biological Inst.

E. KRUCH.

Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 97, No. 1, p 81-93, June 1986.

9 fig. 3 tab, 15 ref. Japan Special Research Project on Environmental Science Grants 58030003, 59030004, 60030005.

Descriptors: *Polychaetes, *Neanthes, *Intertidal areas, *Mud flats, *Oxygen uptake, *Carbon dioxide, *Nanakita River, *Estuaries, *Japan, *Bioturbation, Annelids, Estuarine environment, Benthic fauna, Aquatic life, Biomass, Respiration.

The benthic oxygen consumption and carbon dioxide production of undisturbed and sieved sediment cores with various values for the biomass of polychaetes collected from the intertidal mud-flat of Nanakita River estuary of Japan, were measured simultaneously. The benthic oxygen consumption and carbon dioxide production increased in proprious to the biomass of a dominant polychaete. portion to the biomass of a dominant polychaete species (Neanthes japonica). This increase was not explained by the respiration of the animals alone. The residual increase in benthic O2 and CO2 fluxes may be due to mineralization processes in the burrow wall and enhanced diffusion caused by the ourrow wall and enhanced dirusion caused by the pumping activity of the worms. From the average biomass of polychaetes at the study site, total benthic O2 and CO2 fluxes were estimated to be 5.2 mmol/sq m/hr and 7.3 mmol/sq m/hr, respectively, at 20 C. The worms were responsible for 79% of the total O2 flux and 73% of the total CO2. flux, but the respiration of the worms accounted for only 53% of the total O2 flux and 36% of the total CO2 flux. The residual enhanced fluxes were 26% and 37% for the total O2 and CO2 fluxes, respectively. (Author's abstract) W87-00805

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PERMEATION AND THERMAL OSMOSIS OF WATER THROUGH CELLULOSE ACETATE MEMBRANES,

Universidad Complutense de Madrid (Spain). Fa-cultad de Ciencias Fisicas. J. I. Mengual, F. G. Lopez, and C. Fernandez-

Journal of Membrane Science, Vol. 26, No. 2, p 211-230, March 1986, 7 fig. 3 tab. 36 ref.

Descriptors: *Membranes, *Membrane processes, *Osmosis, Cellulose acetate membranes, Thermalosmosis, Permeability, Permeation, Thermoosmo-

Isothermal permeation and thermal osmosis of pure water through cellulose acetate membranes was studied. Influence of temperature and stirring rate on isothermal permeation was examined and the activation energy for permeation was calculated. In the case of thermal osmosis, experiments examined thermoosmotic flows and evolution towards steady states. In both cases the experiments have been performed by varying separately the temperature differences, the mean temperature and the stirring rate. The influence of stirring rate on thermal osmosis showed that temperature polarization cannot be avoided with the experimental setup, but its influence may be evaluated. A method is proposed to evaluate the differential thermoosmotic permeability. The results obtained from steady states are more reliable than those obtained from thermoosmotic flows. (Author's abstract)

3B. Water Yield Improvement

SNOWPACK AUGMENTATION RESEARCH NEEDS: A HISTORY OF WEATHER MODIFI-CATION IN COLORADO, Colorado Dept. of Natural Resources, Denver. Weather Modification Program.

B. C. Welles.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-165373, Price codes: A05 in paper copy, A01 in microfiche. Final Report, June 1982. 97 p, 3 tab, 10 ref. Cooperative Agreement No. 9-07-85V0027.

Descriptors: *Snowpack, *Research priorities, *Weather modification, *Colorado, Water supply development, Orographic precipitation, Cloud seeding, Legislation, Policy making.

Weather modification activity in Colorado is regu-lated by state statute (Title 35, Article 20, C.R.S. 1973) and administered by the state Department of Natural Resources. The main focus of weather Natural Resources. The main focus of weather modification activity in the state is the augmentation of winter snowpack. Federal research programs have included hail suppression, snowpack augmentation, and the transport and diffusion of seeding materials. Commercial projects to affect precipitation have been conducted to suppress hail, to increase rain, and to augment winter snowpack with the last being the predominant commercial activity in recent years. This document includes identification of needed research projects of particular importance to the state, a history of Colorado weather modification legislation and brief descriptions of projects conducted after 1972 from the files of the Department of Natural Resources. (Author's abstract)

RESEARCH ON EVOLVING DESIGN AND EVALUATION OF THE HIPLEX PROGRAM: FINAL TECHNICAL REPORT,

South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Use Of Water Of Impaired Quality-Group 3C

P. L. Smith, P. W. Mielke, K. J. Berry, A. A.
Poneaud, and R. D. Farley.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB83-169060,
Price codes: A07 in paper copy, A01 in microfiche.
Report No. 82-7, November 1982, 127 p, 13 fig, 8
tab, 56 ref, 5 append. Contract No. 8-07-83-V0009.

Descriptors: *HIPLEX, *Weather modification, *Cloud seeding, *Chemistry of precipitation, *Statistical analysis, Cloud physics, Montana, Cumulus clouds, Rain gages, Remote sensing, Satellite technology, Simulation analysis, Aircraft.

rology, Simulation analysis, Aircraft.

Five years of research related to the design, conduct, and evaluation of the U.S. Bureau of Reclamation's HIPLEX program are summarized. Most of this research concerned the HIPLEX-1 experiment that involved randomized seeding of small Montana cumulus congestus clouds with dry ice. The report discusses the design, conduct, and response variables of HIPLEX-1 and presents a statistical evaluation of the experiment. It also summarizes the results of related physical, statistical, and numerical cloud modeling studies. The physical studies included analyses of HIPLEX aircraft, mesonet, radar, and rain gage data. The statistical investigations were concerned mainly with the development and application of the multi-response permutation procedures (MRPP) used for the statistical evaluation of HIPLEX-1. The numerical modeling studies included simulations of each of the HIPLEX-1 test cases. (Author's abstract)

METEOROLOGICAL FEASIBILITY OF WIND-MILLS FOR WATER SUPPLY IN NORTHERN MALAWI, Northumbrian Water Authority, Gosforth (Eng-

land). D. R. Archer.

D. R. Archer.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
335-343, 5 fig. 1 tab, 6 ref.

Descriptors: *Windmills, *Water conveyance, *Malawi, Wind velocity, Pumping, Water supply, Water yield, Irrigation practices.

water yield, irrigation practices.

The availability of a water supply for domestic and stock use is a limiting factor in the development of rural areas in Malawi. The meteorological feasibility of windmills to obtain a supply is investigated. Variations in wind speed with location, season and time of day are outlined. Manufacturer's wind pump ratings were obtained to determine volume of water pumped at various wind speeds and specified heads. Volumes of water pumped are estimated from five daily readings of wind speed for three mill diameters and two operating elevations. The amount of storage required to sustain a given yield is determined by mass curve analysis. It is concluded that windmills are ideal for stock water supply, as supply appears to fluctuate with demand. However, yields are low during the wet season, and domestic supplies would require substantial storage or "rpplementation from another source. (See also W87-00086) (Author's abstract)

RESULTS OF SEEDING FOR DYNAMIC EF-FECTS ON RAIN-CELL PROPERTIES IN FACE-2, Hebrew Univ., Jerusalem (Israel). Dept. of Atmos-

pheric Sciences.

A. Gagin, D. Rosenfeld, W. L. Woodley, and R. E. Lopez.

Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 1, p 3-13, January 1986. 2 fig, 10 tab, 16 ref.

Descriptors: *Cloud seeding, *Artificial precipita-tion, *Florida, *Volume scan radar, *Cell height, *Prediction, National Hurricane Center, Florida Area Cumulus Experiment, Weather modification, Cloud physics.

Volume scan radar studies carried out in south Florida within the framework of the Florida Area

Cumulus Experiment, stage 2 (FACE-2), program used two different, but virtually colocated, radar systems (WSR 57 S-Band radar of the National Hurricane Center and MPS-4 C-Band radar of the University of Miami) to define and track convective rain cells through their lifetimes. The study sought to explore and verify in quantitative terms the basic tenet of the technique of cloud seeding aimed at producing dynamic effects and employed the data heights, intensities, precipitation areas, durations, and total rain volume of convective rain cells to estimate the effect of seeding on their properties. Seeding appeared to affect the properties of cells so as to increase their total rainfall; positive changes in cell properties could be predicted from changes in maximum cell height following seeding. The effect of seeding appeared to be strongest for cells treated early in their life cycle with a substantial amount of AgI (e. more than 600 g). Increases of 22% in cell height and 100% in cell rain volume resulted from such seeding. The positive effects of AgI seeding on some cells may have resulted in compensating negative effect on the smaller untreated clouds forming near the treated cells. (Rochester-PTT)

3C. Use Of Water Of Impaired

ENVIRONMENTAL EFFECTS OF APPLYING FEEDLOT RUNOFF TO GRASSLAND PLOTS, Baghdad Univ. (Iraq). Coll. of Engineering. N. A. Al-Masri. IN: Effects of Water Disposal on Groundwater and Surface Water, IAitS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 113-121, 5 tab, 8 ref.

Descriptors: *Feedlot runoff, *Environmental effects, *Grasslands, Impaired water use, Wastewater disposal, Chemical oxygen demand, Raw water, Groundwater quality, Statistical analysis.

Chemical oxygen demand, Raw water, Ground-water quality, Statistical analysis.

The purpose of this study was to determine the effects on surface runoff and shallow groundwater quality of applying different rates of feedlot runoff on grassland plots. Lot runoff from an experimental station was collected into a lagoon. The lagoon effluent was then pumped to a field and applied to 15 experimental plots via a sprinkler irrigation system. Each plot was equiped for collecting surface runoff and shallow groundwater samples. Samples were collected following natural or simulated rainfall and analyzed for selected water quality parameters. The results of the study indicated the following conclusions: (a) The concentration of ammonia nitrogen and total kjeldahl nitrogen in the surface runoff and groundwater exceeded the maximum standard of raw water due to the application of all the different rates of lagoon effluent. (b) In some cases, chemical oxygen demand concentration in the plot's surface runoff was 70 times higher than that measured in a nearby creek water. However, average chemical oxygen demand of groundwater was about 4 times lower than that of surface runoff. (c) The concentrations of total oxidized nitrogen, electrical conductivity, pH, total solids, chloride and total phosphorus measured in each plot's surface runoff and groundwater were within the standard. However, total oxidized nitrogen concentration measured in the groundwater of some plots was about 10 times higher than that measured in the plots surface runoff. (d) Statistical analysis showed that different application rates of lagoon effluent were significantly different with total phosphorus and electrical conductivity in the plots' groundwater samples. A quadratic regression equation was found to predict the electrical conductivity in the groundwater and conductivity in the groundwater (e) Weather and soil conditions were factors affecting ammonia nitrogen, total oxidized nitrogen and chemical oxygen demand concentrations in surface runoff. (See al

OPTIMAL WATER MANAGEMENT STRATE-GIES FOR SALINITY CONTROL.

Central Soil Salinity Research Inst., Karnal (India). For primary bibliographic entry see Field 5G. W87-00195

EFFECTS OF SODIUM CHLORIDE ON GROWTH AND NITROGEN FIXATION IN CASUARINA OBESA MIQ., Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.

For primary bibliographic entry see Field 2I. W87-00214

MASS SELECTION FOR SALT RESISTANCE IN RHODES GRASS (CHLORIS GAYANA), Tel-Aviv Univ. (Israel). Dept. of Botany. For primary bibliographic entry see Field 2I. W87-00251

CHANGES INCLUDE BY SALINITY TO THE ANATOMY AND MORPHOLOGY, OF EX-CISED PEA ROOTS IN CULTURE, Hebrew Univ., Jerusalem (Israel). Dept. of Botany. For primary bibliographic entry see Field 2I. W87-00262

EFFECTS OF NACL STRESS ON PROLINE AND CATION ACCUMULATION IN SALT SENSITIVE AND TOLERANT TURFGRASSES, Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences. For primary bibliographic entry see Field 2I. W87-00267

PREDICTING SALINIZATION AND SODIFI-CATION OF A BARE SANDY LOAM SOIL AFTER IRRIGATION WITH POOR-QUALITY WATER INTERSPERSED WITH RAIN, Haryana Agricultural Univ., Hissar (India). Dept. of Soils.

of Soils.

A. K. Kapoor, and R. Pal.

Soil Science SOSCAK, Vol. 141, No. 4, p 281-288,

April 1986. 5 fig, 4 tab, 15 ref.

Descriptors: *Salinization, *Sodification, *Sandy loam soil, *Irrigation, *Rain, *Evaporation, Sodium, Burns models, Gapon equations, Cation exchange equilibrium, Mathematical models, Conductivity, Saline soils, Prediction.

ductivity, Saline soils, Prediction.

Models based on miscible displacement and cation exchange, were used to predict accumulation of total salts and exchangeable sodium in a sandy loam soil after redistribution, as well as evaporation, following irrigation with saline sodic water or rain. The Burns model was modified by replacing the evaporation limit with actual moisture content in the soil profile to predict electrical conductivity (EC sub 1:2, mmhos/cm) at various soil depths. The model used for predicting exchangeable sodium percentage (ESP) was based on the Gapon equation to describe cation exchange equilibrium. To test these models, experimental data were collected from a 3.6-x 3.6-m plot for a cycle of niae irrigations with water of high sodium absorption ratio (SAR) interspersed with different intensity rains. The observed values of EC and ESP were in good agreement with those predicted for different soil layers. (Author's abstract)

CONSTANT FEEDING OF FIELD-GROWN TO-MATOES IRRIGATED WITH SULPHATE WATER,

Agricultural Research Inst., Nicosia (Cyprus). For primary bibliographic entry see Field 3F. W87-00312

MINERAL AND ORGANIC SOLUTES ACCU-MULATION IN PLANTAGO ALBICANS GROWN IN PRESENCE OF SODIUM CHLO-RIDE (ACCUMULATION DE SOLUTES MIN-ERAUX ET ORGANIQUES CHEZ PLATAGO ALBICANS CULTIVE EN PRESENCE DE CHLORURE DE SODIUM),

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C-Use Of Water Of Impaired Quality

Tunis Univ. (Tunisia). Faculty of Science.
B. Henchi, M. Lachaal, J. Gerard, and F. Larher.
Comptes Rendus de l'Academie des Sciences,
Paris, Series 3,CHDDAT, Vol. 302, No. 3, p 103108, January 21, 1986. 5 fig, 1 tab, 32 ref.

Descriptors: *Vegetation, *Solutes, *Saline water, *Plant growth, Salinity, Chemical properties, Sodium chloride.

When Plantago albicans is cultivated in nutrient solutions enriched with sodium chloride its growth rate is restricted. Osmotic adjustment, mainly performed through Na(+) and Cl(-) storage, is not sufficient to satisfy water requirements. Growth inhibition is also related to a decrease in K(+) and Ca(2+) levels and to significant changes in the content of various organic solutes. High concentrations of NaCl give rise to an increase in free asparagine and arginine concentrations, an enhanced starch content and a depressed level of the soluble carbohydrates. Therefore the changes in carbohydrates might be associated with D-sorbitol accumulation in whole parts of the plants. The functions of D-sorbitol were identified for the first time by 13-CNMR. (Master-PTT)

RESPONSES OF THREE WHEAT CULTIVARS TO SIMULATED ACID RAIN, Oak Ridge National Lab., TN. Environmental Sci-For primary bibliographic entry see Field 5C. W87-00410 ences Div.

CROP PRODUCTION AND MANAGEMENT UNDER SALINE CONDITIONS, Agricultural Research Organization, (Bet-Dagan (Israel). Inst. of Soils and Water. A. Meiri, and Z. Plaut. Plant and Soil PLSOA2, Vol. 89, No. 1-3, p 253-271, 1985. 11 fig. 3 tab, 52 ref.

Descriptors: *Crop production, *Irrigation practices, *Salt tolerance, *Salinity, *Management planning, Saline water, Fertilization, Plant growth, Crop yield, Leaching, Root zone.

Management practices that may minimize yield reduction under saline conditions according to three strategies are the control of root-zone salinity, reduced damage to the crop, and reduced damage to individual plants. Control of root zone salinity is obtained by irrigation and leaching. Intermittent leaching is more advantageous than leaching at each irrigation. Specific cultivation and irrigation practices that result in soil salinity at appecifically sensitive growth stages may be very irrigation practices that result in soil salinity at specifically sensitive growth stages may be very beneficial. Reduced damage at the field level when soil or irrigation water salinity is too high to maintain full yield of single plants requires a larger crop stand. For row crops reduced inter-row spacing, is more effective than reduced intra-row spacing, is more effective than reduced intra-row spacing, the salinity tolerance of the plant level while the salinity tolerance of the plants remains constant shows up in the response curve parameters as larger threshold and slope and constant salinity at zero yield. Changes in the salt tolerance of the crop were found at different growth stages, under different atmospheric CO2 levels, and under different fertilization and irrigation practices. (Geiger-PTT) W87-00541

CROP TOLERANCE TO SALINE SPRINKLING

WATER, Agricultural Research Service, Riverside, CA. Salinity Lab. E. V. Mass.

Plant and Soil PLSOA2, Vol. 89, No. 1-3, p 273-284, 1985. 3 fig, 2 tab, 25 ref.

Descriptors: *Saline water, *Crop production, *Salt tolerance, *Irrigation practices, *Sprinkler irrigation, Salinity, Plant growth, Management planning, Irrigation water, Fertilization, Agronomy, Irrigation effects, Irrigation efficiency.

Crops sprinkled with saline irrigation water are subject to foliar salt absorption and injury as well as to injury from soil salinity. Yield reductions

caused by soil salinity are presented for 71 agricultural crops categorized as fiber, seed and sugar crops, grasses and forage crops, and vegetable and fruit crops, particularly tree crops, essentially no data is available to predict yield losses as a function of the salt concentration of the irrigation water. Salinity thresholds for sprinkling-induced foliar injury are estimated for some crops. The degree of salt damage experienced by crops is affected by climatic conditions, salt absorption rates by leaves, plant species, irrigation practices, soil conditions, and fertilization practices. To reduce the damage from saline sprinkling it is suggested that irrigation be applied below the leaf canopy when the salt adsorption rate is at a minimum. Also, infrequent heavy irrigations are less damaging than frequent light irrigations. (Geiger-PTT)

EFFECT OF SALINITY ON QUALITY OF VAR-IOUS AGRICULTURAL CROPS, Ben-Gurion Univ. of the Negev, Beersheba (larsel), Boyko Inst. for Agriculture and Applied

Biology. Y. Mizrahi, and D. Pasternak. Plant and Soil PLSOA2, Vol. 89, No. 1-3, p 301-

Descriptors: *Vegetable crops, *Fruit crops, *Saline water, *Irrigation effects, *Taste, Crop production, Crop yield, Salt tolerance, Plant growth, Irrigation water, Cabbage, Lettuce, Pea-

The effects of saline irrigation water on the quality, especially taste, of various crops grown in the Negev Desert of Israel were studied. Fruits from a Negev Desert of Israel were studied. Fruits from a processing tomato cultivar exposed to various degrees of salinity had higher values for total soluble solids (TSS) and acidity than their controls. The yield of fruit after saline water irrigation was lower, but this was offset by the higher fruit quality and its consequent higher value. Melon fruits from plants subjected to saline water scored higher in taste than their controls when the fruits were analyzed fresh. After 3-4 wk of storage at room temperature, there was no longer any difference in taste. Even though salinity slightly increased the TSS content, this did not correlate with the taste scores. Iceberg lettuce grown with saline water did not significantly differ in taste from its control, even when the sensitive triangle taste test was used. The same was true for peanuts. It was coneven when the sensitive triangle taste test was used. The same was true for peanuts. It was concluded that for these two crops no advantage of better quality would compensate for possible lower yields. Salinity had little effect on the yield of two varieties of Chinese cabbage, but increased the frequency of tipburn. (Geiger-PTT) W87-00543

AGRICULTURAL PRODUCTION OF HALO-PHYTES IRRIGATED WITH SEAWATER, Arizona Univ., Tucson, Environmental Res

Arizona Univ., Tucson. Environm

J. W. O'Leary, E. P. Glenn, and M. C. Watson. Plant and Soil PLSOA2, Vol. 89, No. 1-3, p. 311-321, 1985. 5 tab, 32 ref.

Descriptors: "Halophytes, "Salt tolerance, "Crop production, "Seawater, "Forages, Irrigation prac-tices, Crop yield, Plant growth Saline Water, Seeds, Fodder.

Growing agricultural crops with direct seawater irrigation has progressed within the past few years from the conceptual to the experimental phase. This has been accomplished by selecting halophytes with inherently high salinity tolerance for use as crop plants rather than by increasing the ability of traditional crop plants to tolerate seawater. Some of the halophytes being investigated for use as crops in seawater irrigation scenarios have high nutritional value as forage or fodder crops. Most of them also have high digestibility. The limiting factor in such use is their high salt content, but this limitation can be moderated. However, since seeds of halophytes do not accumulate salt any more than do those of glycophytes, the greatest promise for seawater-irrigated halophytes probably will be as seed crops. The seeds of many halophytes have high protein and oil con-

tents and compare favorably with traditional oil-seed crops. Sustained high yields of seed and bio-mass already have been obtained from some halo-phytes irrigated with seawater, and within the next year seawater agriculture should proceed from the experimental to the operational phase. (Author's

W87-00544

HALOPHYTIC CROPS FOR CULTIVATION AT SEAWATER SALINITY, Delaware Univ., Lewes. Coll. of Marine Studies.

J. L. Gallagher.
Plant and Soil PLSOA2, Vol. 89, No. 1-3, p 323336, 1985. 6 fig, 4 tab, 21 ref.

Descriptors: *Halophytes, *Salt tolerance, *Saline water, *Irrigation practices, *Seawater, Plant growth, Salinity, Forages, Vegetable crops, Seeds, Proteins, Crop production, Agronomy, Grasses, Crop yield, Hay, Feeds.

Several hundred halophytes from salt marshes and salt deserts of the world were evaluated for development as crops in the saline desert at the American University in Cairo research station in Sadat City. Sporobolus virginicus cultivars are being studied for use as both hay and pasture material, while a Distichilis spicata cultivar and a Spartina patens cultivar are being tested as hay crops. Forage yields of these various cultivars, when harvested as hay crops, range to 6.9 or more tons per acre, depending on the salinity and other environmental conditions, and the crude protein content as indicated by the nitrogen content ranges from 6 to 10%. Cultivars having the most useful agronomic qualities have been identified and are being increased in quantity. The grain crop Kosteletzkya virginica produces a seed which resembles millet; its whole seeds contain approximately 25% protein and 15% oil. The vegetable Atriplex triangularis has been under mass selection for 4 yr; a cultivar has been identified and seed is now being increased for this species. (Geiger-PTT) W87-00545

DEVELOPING THE SEAWATER AGRICUL-

Ben-Gurion Univ. of the Negev, Beersheba (Israel). Boyko Inst. for Agriculture and Applied D. Pasternak, A. Danon, J. A. Aronson, and R. W.

Plant and Soil PLSOA2, Vol. 89, No. 1-3, p 337-348, 1985.

Descriptors: *Halophytes, *Salt tolerance, *Saline water, *Irrigation practices, *Seawater, Fodder, Feeds, Crop yield, Plant growth, Salinity, Seeds, Proteins, Crop production, Agronomy.

Proteins, Crop production, Agronomy.

Work on developing halophytic fodder plants is being carried out at an experimental field, located 100 meters from the Mediterranean seashore. Since 1982, 120 species have been tested. Of these, 26 have performed at least as well under irrigation with 15% seawater. Species that performed extremely well were Atriplex lentiformis, A. barclayana, A. atacamensis, A. undulata, and an Atriplex species from Camarones in Argentina. Atriplex nummularia irrigated with 100%, 75%, and 15% seawater had annual yields of dry matter of 1.53, 2.12, and 2.89 kg/sq m, respectively. Ash content was very high from 25 to 40% of the dry weight, depending on the treatment and season. Crude protein content was 15-21%. A largescale feeding trial was carried out to test the value of A. nummularia as a protein supplement for sheep grazing on wheat aftermaths. The daily intake of dry matter was 400 g per head, which was effective only with the daily addition of 400 g corn meal per head. At present, the main limiting factor in the development of seawater-irrigated fodder is the low feed intake. (Geiger-PTT) W87-00546

GROWTH, MINERAL NUTRITION, ORGANIC CONSTITUENTS AND RATE OF PHOTOSYN-

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Use Of Water Of Impaired Quality—Group 3C

THESIS IN SESBANIA GRANDIFLORA L. GROWN UNDER SALINE CONDITIONS, Shivaji Univ., Kolhapur (India). Dept. of Botany. P. D. Chavan, and B. A. Karadge. Plant and Soil PLSOA2, Vol. 93, No. 3, P 395-404, 1986 3 abs. 3 fb. 37 mc. Plant and Soil PLEUAL, 1986. 3 tab, 2 fig, 37 ref.

Descriptors: *Salinity, *Agriculture, *Legumes, India, Potassium, Chlorophyll, Sodium, Iron, Proline, Chlorides, Photosynthesis.

line, Chlorides, Photosynthesis.

Sesbania grandiflora (Linn.) Poir, also known as S. Formosa (F. Maller) species with a very wide range of economic importance, was studied with respect to salinity tolerance. Sesbania showed a luxuriant growth in soil with an electrical conductivity of up to 10 m/Scm. Under saline conditions Na and Cl accumulated at different rates in the plants. Accumulation of these ions in the leaf rachis compared with leaflets appears to be an adaptive feature of this legume. Maintenance of an optimum K level and accumulation of Ca are also indicative of a salt-tolerance mechanism. Accumulation of Fe in the roots of salt-stressed plants is noteworthy. Organic acids and soluble sugars which accumulated in plants under stress condition may play a role in osmotic adjustment. The level of proline remained unaltered. Though the chlorophyll content of the leaves decreased, the photosynthetic rate was enhanced by saline conditions. Sesbania grandiflora is a high quality fodder for cattle, a green manure and a nourishing vegetable. (Alexander-PTT)

W87-00552

CONTROL OF NA(+) AND K(+) TRANSPORT IN SPERGULARIA MARINA: III, RELATION-SHIP BETWEEN ION UPTAKE AND GROWTH AT MODERATE SALINITY, Illinois Univ. at Urbana-Champaign. Dent. of Plant

Biology. For primary bibliographic entry see Field 2I. W87-00555

SALT BALANCE OF LEAVES OF THE MAN-GROVE AVICENNIA MARINA, Tel-Aviv Univ. (Israel). Dept. of Botany. For primary bibliographic entry see Field 2I. W87-00556

EFFECTS OF DIFFERENT SOIL WATER PO-TENTIALS, TEMPERATURE AND SALINITY ON GERMINATION OF SEEDS OF THE DESERT SHRUB ZYGOPHYLLUM DUMO-

For primary bibliographic entry see Field 2I. W87-00557

GROWTH AND SOLUTE ACCUMULATION IN 3-WEEK-OLD SEEDLINGS OF AGROPYRON ELONGATUM STRESSED WITH SODIUM AND POTASSIUM SALTS, Agricultural Research Service, Riverside, CA. Salinty Lab.

ity Lab. For primary bibliographic entry see Field 2I. W87-00558

SALT TOLERANCE OF EGGPLANT, Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water. For primary bibliographic entry see Field 2I. W87-00670

SEWAGE EFFLUENTS AS DRINKING WATER FOR NIGERIAN POULTRY, Ibadan Univ. (Nigeria). M. K. Sridhar, T. E. Ekpenyong, and O. I. A. Effluent and Water Treatment Journal EWTJAG, Vol. 25, No. 9, p 327-330, September 1985, 2 fig, 5 tab, 10 ref.

Descriptors: *Sewage effluents, *Drinking water, *Nigeria, *Poultry, Aluminum, Minerals, Trickling filters, Wastewater treatment, Potable water, Bio-

logical wastewater treatment, Activated sludge, Alum, Flocculation.

One of the major problems facing the poultry industry in Nigeria is a shortage of drinking water. It was established that dried activated aludge could be used as a feed additive for swine, sheep, beef industry in Nigeria is a shortage of drinking water. It was established that dried activated sludge could be used as a feed additive for swine, sheep, beef cattle and poultry. Half of the vegetable and animal protein supplements in the diet of chickens could be supplied by activated sludge when the amino acids, vitamin, and mineral contents of sewage were enriched. The present study was aimed at obtaining information on the suitability of sewage effluents as a source of drinking water and its effects on the performance of the laying chicken. Performance was measured by following the body weight gain, feed and water consumption rates, egg production, feed conservation efficiency and the serum cholesterol levels. The present study was the first of its kind in Nigeria to meet the growing demand for fresh water in rearing poultry throughout the country. Sewage effluents obtained by chemical flocculation with alum and biological treatment by trickling filter and activated sludge processes were used. The chemically treated effluents however, still contained considerable amounts of organic and mineral matter and metallic ions such as aluminum. The study revealed that the laying chickens preferred sewage effluents which influenced feed consumption. The birds were healthy and did not show any signs of discomfort. However, the alum flocculated sewage effluents from the sewage effluents in the reduccion in the sewage effluents in the reason was not clear but the minerals present in the sewage effluents and the aluminium ions could be responsible for the reduction. (Khumbatta-PTT) W87-00689

MECHANISM OF SALT TOLERANCE IN WILD RICE (ORYZA COARCTATA ROXB), Central Soil Salimity Research Inst., Karnal (India). A. R. Bal, and S. K. Dutt.
Plant and Soil PLSOA2, Vol. 92, No. 3, p 399-404, 1006 2 3 ab. 11 and 1

Descriptors: *Rice, *Saline water, *Salt tolerance, Wild rice, Irrigation, India, Plant tissues, Plant growth, Potassium, Mangnesium, Calcium, Toxicity, Agriculture, Coastal waters, Impaired water

Oryza coarctata, a highly salt-resistant wild rice species, is commonly found on the banks of coastal rivers in India. This species can also withstand saline water (20 to 40 dS/m E.C) submergence for saline water (20 to 40 dS/m E.C) submergence for quite a long period. It was found that O. coarctata has some special unicellular salt hairs (trichomes) on the adaxial surface of the leaves, by which they efficiently maintain a low concentration of toxic salts in the plant tissue. Sodium and chloride were the dominant ions in the excreted material but they also excrete potassium, magnesium and calcium. With the increase in soil salinity sodium, magnesium and chloride excretion increased. O. coarctata maintained the optimum mineral concentration in its tissues. Maximum accumulation of potassium was observed in the leaves. With the increase in salt stress total biomass production and osmotic was observed in the leaves. With the intrease is all stress total biomass production and osmotic potential increased over control but there was no change in the moisture percentage of leaves. (Author's abstract) W87-00722

SALT SENSITIVITY IN WHEAT: A CASE FOR

SALIT SENSITIVITY IN WHEAT: A CASE FOR SPECIFIC ION TOXICITY, California Univ., Davis. Dept. of Land, Air and Water Resources. R. W. Kingsbury, and E. Epstein. Plant Physiology PLPHAY, Vol. 80, No. 3, p 651-654, March 1986. 8 tab, 30 ref.

Descriptors: *Wheat, *Salt tolerance, Salinity, Toxicity, Ions, Plant growth, Chlorine, Impaired water use, Sodium, Chlorides.

Two selected lines of bread wheat, Triticum aesti-vum L., differing in their relative salt resistance,

were grown in isosmotic solutions of different ionic compositions to investigate sensitivity to spe-cific ions. Growth rates and ion accumulation were compositions to investigate sensitivity to specific ions. Growth rates and ion accumulation were determined. The salt composition of the various solutions had little effect on the growth of the salt-resistant line, but significantly affected that of the salt-sensitive line. Specifically, solutions containing high Na(+) concentrations were more toxic than those containing high Cl(-) concentrations or high concentrations of nutrient ions. There were few differences in ion accumulation between lines in a given treatment, although the sensitive line tended to accumulate more Na(+) than the tolerant line in the salt treatments with high Na(+) concentrations. The overall results provide evidence that there is a definite specific ion effect which is related to salt sensitivity in wheat. Superior compartmentation of toxic ions, principally Na(+), may be a mechanism of salt resistance in this case. (Author's abstract)

INHIBITION OF CELL DIVISION BY PRO-LINE ANALOGUES: REVERSAL BY PROLINE AND HIGH SALINITY, University of Western Ontario, London. Dept. of Plant Sciences.

For primary bibliographic entry see Field 5C. W87-00731

VESICULAR-ARBUSCULAR MYCORRHIZAL (GLOMUS FASCICULATUM) INFLUENCE ON SOYBEAN DROUGHT TOLERANCE IN HIGH PHOSPHORUS SOIL,

Oregon State Univ., Corvallis. Dept. of Microbi-For primary bibliographic entry see Field 21.

DIFFERENTIAL RESPONSE OF NONSELECT-ED AND NA2SO4-SELECTED CALLUS CUL-TURES OF BETA VULGARIS L. TO SALT

SIMESS, Calgary Univ. (Alberta). Dept. of Biology. by. E.-C. Pua, and T. A. Thorpe. Journal of Plant Physiology IPPHEY, Vol. 123, No. 3, p 241-248, April 1986. 3 fig, 2 tab, 19 ref. Natural Sciences and Engineering Research Coun-cil of Canada Grant G09049.

Descriptors: *Cultures, *Salt tolerance, *Sodium sulfate, *Selective media, Sodium chloride, Plant physiology, Water potentials, Plant growth, Stress, Growth rate.

Growth rate.

Cultures of nonselected and Na2SO4-selected callus of Beta vulgaris were grown on medium containing increasing levels of Na2SO4 (max. 280mM) or NaCl (max. 560 mM) for two passages. Nonselected callus maintained in the absence of salt grew equally well on salt-free medium and medium containing 70 mM Na2SO4 or NaCl, but growth decreased significantly at salt concentrations higher than 70 mM, and the callus died at 420 and 560 mM NaCl. In contrast, Na2SO4-selected callus maintained at 210 mM Na2SO4 or 140 mM NaCl. Growth index, dry weight, and fresh weight/dry weight of the selected callus were significantly higher than those of nonselected callus on medium containing Na2SO4 or NaCl. Growth of both cultures was more efficient on NaCl than Na2SO4 at salt concentrations higher than 70 mM. No differences between nonselected and selected callus were observed with respect to the effect of salt type on water relations of the cultures. Callus grown on NaCl medium showed less negative water potential and osmotic potential than that grown on Na2SO4 medium, but both water potential and osmotic potential increased with increased salt concentration. (Author's abstract) W87-00806

RESPONSES OF KENAF TO SALT STRESS: GERMINATION AND VEGETATIVE GROWTH.

California Univ., Davis. Dept. of Land, Air and

Field 3-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C-Use Of Water Of Impaired Quality

Water Resources. P. S. Curtis, and A. Lauchli. Crop Science CRPSAY, Vol. 25, No. 6, p 944-949, November-December 1985. 2 fig. 4 tab, 29 ref.

Descriptors: "Salt stress, "Kenaf, "Hibiscus, "Germination, "Plant growth, "Salt tolerance, Crop yield, Fiber crops, Plant physiology, Saline water.

yield, Fiber crops, Plant physiology, Saline water. The response of kenaf (Hibiscus cannabinus L.), a stem-fiber plant, to salt stress was investigated during germination and early growth in solution culture under greenhouse conditions. Kenaf has been considered for use as a summer crop in areas with warm summers and low quality water. Germination was only slightly impaired by NaCl salinity up to 200 mmol/L. Dry weight accumulation after 6 weeks' growth was reduced 20 to 40% by 75 mmol/L. NaCl and 70 to 80% by 150 mmol/L. Vegetative development of the three cultivars, C-108, G-45, and E-71, and the breeding line 15-2X, were similar under these salt treatments. Rate of leaf emergence and leaf relative growth rate declined linearly with increasing salt stress. Kenaf responds to salt stress by excluding Na(+) from expanding leaf tissue. It is suggested that kenaf is suitable for cultivation with irrigation water of marginal quality but not in severely salt affected areas. (Author's abstract) W87-00807

3E. Conservation In Industry

REUSING POWER PLANT COOLING WATER TO REDUCE MAIN BREAKS, Manitowoc Public Utilities, WI.

Jaumal of the American Water Works Association JawWA5, Vol. 77, No. 11, p 47-52, November 1985. 6 fig. 8 tab.

Descriptors: *Water mains, *Electric powerplants, *Cooling water, *Water reuse, Wisconsin, Manitowac, Lake Michigan, Water quality, Water temperature, Feasibility studies, Cost analysis.

The attempt to reduce the number of winter water main breaks by the use of warm cooling waters from a nearby electric generating plant was studied in a fall scale project in Manitowoc, Wisconsin. The power plant cooling water was used in lieu of Lake Michigan as the winter raw water source. In two winter seasons of full-scale operation, the number of main breaks was reduced by an average of thirty-three percent. Community energy consumption was estimated to have decreased by more than 51%. The cost savings of the project was partially offset by increased chemical feed, sewage penalties and increased filter runs. (Jessick-PTT) W87-00490

3F. Conservation In Agriculture

RAINSTORM CHARACTERISTICS AFFECT-ING WATER AVAILABILITY FOR AGRICUL-TURE

Bodan Univ. (Nigeria). Dept. of Geography. For primary bibliographic entry see Field 2A. W87-00090

SELECTION OF SOIL AND WATER CONSERVATION PRACTICES FOR A GIANT BAMBOO PLANTATION IN TARWAN, National Chunghsing Univ., Taichung (Taiwan). Dept. of Soil and Water Conservation.

S. L. Liang.
IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg. West Germany, August 15-27, 1983. p 265-272, 7 fig. 1 tab, 15 ref. Research Project Nos. NSC-66-B0409-04(1), 77-ARDP-5.2-N-94(5) and 79-ARDP-3.2-N-190(B4).

Descriptors: *Soil conservation, *Water conserva-tion, *Bamboo, *Taiwan, *Agriculture, Grasses,

Runoff rates, Organic matter, Hydrogen ion con-centration. Topsoil

Attempts to find a suitable supplementary conservation measure for a sloping giant bamboo plantation in Taiwan already traversed by ditches, are discussed. Five treatments are compared: Bahia grass, Geania grass, one-year fallow, natural grass, and natural grass cover without interillage. The experimental plot with a barrier of Bahia grass gave the lowest runoff, the lowest soil loss, the highest organic matter content, the best pH value in the upper 5 cm of topsoil, and a reasonable crop yield in both wet and dry years. The one-year fallow plot gave similar results but the yield was lower at harvest. Therefore the Bahia grass barrier was found to be the best supplementary conservation practice. (See also W87-00086) (Author's abstract) stract) W87-00107

CONTINUOUS MONITORING OF PLANT

CONTINUOUS MONITORING OF PLANT WATER POTENTIAL, Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research. For primary bibliographic entry see Field 2I. W87-00188

CONSUMPTIVE USE AND WATER REQUIRE-MENT OF SOYBEANS, Central Soil and Water Conservation Research and Training Inst., Dehra Dun (India). Div. of Land and Water Resources. For primary bibliographic entry see Field 2I. W87-

COMPARISON OF YIELDS OF SEVERAL CULTIVARS OF FIELD-GROWN SOYBEANS EXPOSED TO SIMULATED ACIDIC RAIN-FALLS, Brookhaven National Lab., Upton, NY. Dept. of

Applied Science.
For primary bibliographic entry see Field 5B.
W87-00215

EFFECT OF WATER DEFICIT ON YIELD AND PROTEIN CONTENT IN PEARL MILLET

International Crops Research Inst. for the Semi-Arid Tropics, Patancheru (India). For primary bibliographic entry see Field 2I. W87-0023

RESPONSE OF SORGHUM TO A WATER GRADIENT AND POTASSIUM VARIABLE, Nevada Univ., Reno. Dept. of Plant, Soil and Water Science For primary bibliographic entry see Field 2I. W87-00252

COMPARATIVE DROUGHT RESISTANCE OF LANDRACES OF SORGHUM AND MILLET FROM DRY AND HUMID REGIONS, Volcani Inst. of Agricultural Research, Bet-Dagan For primary bibliographic entry see Field 2I. W87-00263

CONSTANT FEEDING OF FIELD-GROWN TO-MATOES IRRIGATED WITH SULPHATE

WALLER, Agricultural Research Inst., Nicosia (Cyprus). I. Papadopoulos. Plant and Soil PLSOA2, Vol. 88, No. 2, p 231-236, 1985. 1 fig, 3 tab, 16 ref.

Descriptors: *Trickle irrigation, *Tomatoes, *Ni-trogen, *Fertilizers, Crop yield, Potassium, Phos-phorus, Fertilization, Irrigation practices, Salinity, Crop production.

The response of trickle-irrigated tomato (Lycopersicon esculentum Mill.) to four nitrogen levels continually applied with the irrigation stream was investigated in field studies conducted on Pellic

Vertisol. Waters containing 80, 130, 180, or 230 milligrams N/liter and uniformly supplied with 60 and 150 milligrams/liter of P and K, respectively, were applied four times a week. The resulting N application totals ranged from 472 to 1457 kg N/ha and the total amount of water applied was 590 mm. Appreciable buildup of soil N/03-N occurred below 75 cm depth with the highest amount of N, but not with 80 or 130 milligram N/liter. Soil salinization was similar in all treatments suggesting that the differences in growth and yield may be attributed mainly to the nutritional effect of the N levels. The highest yield (177 tons/ha) was obtained with 180 milligrams N/liter. (Author's abstract) W87-00312

USE OF A SURFACE GAMMA-NEUTRON GAUGE TO MEASURE EFFECTS OF TILL-AGE, CROPPING, AND EROSION ON SOIL

PROPERTIES,
Arizona Univ., Tucson. Dept. of Soils, Water and
Engineering. For primary bibliographic entry see Field 7B. W87-00313

SOYBEAN LEAFLET MOVEMENTS AS AN IN-DICATOR OF CROP WATER STRESS. Arkansas Univ., Fayetteville. Dept. of Agronomy. For primary bibliographic entry see Field 2D. W87-00341

STRUCTURE AND FUNCTIONING OF WATER-STORING AGRICULTURAL POLYA-CRYLAMIDES,

LIVETON Univ. (England). Dept. of Biology.
M. S. Johnson, and C. J. Veltkamp.
Journal of the Science of Food and Agriculture,
36, No. 9, September 1985. 3 fig. 1 tab, 8 ref.

Descriptors: *Water storage, *Soil water, *Plant water potential, *Agriculture, Polyacrylamides, Agricultural hydrology, Field capacity, Wilting

New polyacrylamides have been developed to improve the storage capability and the efficiency by
which plants use water in agriculture and horticulture. These products are particularly useful where
water is scarce or expensive and where drought is
a significant hazard in crop production. However,
there is considerable variation in the water absorption and release capabilities of different products
that is explained by manufacturing conditions.
Scanning electron microscopy shows that high
performance products have a cellular structure in
the expanded condition, with plant-available moisture stored both in enclosed vacuoles and within
the polymer framework. The bridges that comprise
the structure of the gel control water release under the bryiner inactions in the stringer and comparing the structure of the gel control water release under drying conditions and optimize recovery of the stored water by plants. (Author's abstract) W87-00399

USING COMPUTERS TO MANAGE IRRIGA-

TION SYSTEMS, Science and Education Administration, Fort Col-lins, CO. Agricultural Research. G. W. Buchleiter, and D. F. Heermann. Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 354-365, July 1986. 6 fig, 18 ref.

Descriptors: *Computers, *Control systems, *Irrigation efficiency, *Cost analysis, *Sprinkler irrigation, Scheduling, Irrigation design, Load distribution, Remote sensing, Monitoring, Pumps, Cost analysis, Flow control, Computer models, Hydraulic models, Center pivot irrigation, Water use efficiency, Electric power demand.

An integrated water and energy management system using microcomputers can improve the management of center pivot irrigation systems by providing recommendations for irrigation scheduling and selection of the most economical pump combinations. When linked with radio telemetry systems, multiple pivots and pumps can be moni-

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Control Of Water On The Surface—Group 4A

tored and controlled from a single location and interfaced with load control programs. An inteinterfaced with load control programs. An inte-grated irrigation management program, including a pump selection model for branching networks with multiple pump stations in series may reduce moni-toring and control costs that would justify spend-ing \$3,000/pivot for an automatic system. (Mi-chael-PTT) W87-00472

RELATIONSHIPS BETWEEN CLIMATE AND RELATIVE PERFORMANCE OF COTTON IN

NEW SOUTH WALES,
Commonwealth Scientific and Industrial Research
Organization, Narrabri (Australia). Div. of Plant
Industry.

For primary bibliographic entry see Field 2B. W87-00485

WATER STRESS AND SEASONAL EFFECTS ON RUBBER QUALITY IN IRRIGATED GUA-YULE,

Firestone Tire and Rubber Co., Akron, OH. Central Research Labs.
For primary bibliographic entry see Field 2I.
W87-00489

IMPROVING PERFORMANCE OF IRRIGA-TION/HYDRO PROJECTS, Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 6A. W87-00749

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOODS ON RICHLAND CREEK, LITTLE RICHLAND CREEK, BROYLES BRANCH, AND AN UNNAMED TRIBUTARY TO BROYLES BRANCH IN DAYTON, TENNESSEE, AND VICINITY.

Tennessee Valley Authority, Knoxville. Office of Economic and Community Development.

Available from the National Technical Information Service, Springfield, VA. 22161, as DE82-900465, Price codes: A04 in paper copy, A01 in microfiche. Report No., TVA/OECD/FPM-82/21, October 1982. 65 p. 1 fig. 4 tab, 10 plates, 5 ref, 1 append.

Descriptors: *Floods, *Richland Creek, *Little Richland Creek, *Dayton, *Tennessee, Flood plains, Maps, Flood profiles, Land use, Community development, Construction, Building, Zoning, Flood plain management.

Flood plain management.

This flood plain information study provides information for Richland and Little Richland Creeks, Broyles Branch, and an unnamed tributary to Broyles Branch in Dayton, Tennessee, and vicinity. The study was requested by the city to provide information reflecting current flood conditions in order for the community to bettter administer its flood plain management program. The flooded area maps and flood profiles contained in this report and the floodway maps included in the appendix can be used to provide a sound basis for the community's land-use and flood plain management decisions. The first objective can be accomplished by incorporating flood plain provisions, based on the flood data contained in this report, the community's building, zoning, mobile home, and subdivision regulations. These provisions can be structured to establish minimum floor elevations and other construction criteris for both proposed development and substantial improvements to existing development in the flood plain. It can also be used as the basis for study and planning on the part of Dayton in arriving at solutions to existing flooding problems. In addition, the maps and profiles can be used by all members of the community to increase their knowledge of the extent and severity

of flood hazards at specific locations within the community. (Lantz-PTT) W87-00004

TROPICAL STORMS IN CENTRAL AMERICA AND THE CARIBBEAN: CHARACTERISTIC RAINFALL AND FORECASTING OF FLASH

For primary bibliographic entry see Field 2B. W87-00088

RUNOFF AND FLOOD CHARACTERISTICS IN SOME HUMID TROPICAL REGIONS, National Research Center for Disaster Prevention, Sakura (Japan). For primary bibliographic entry see Field 2A.

WATER RESOURCES DEVELOPMENT AND MANAGEMENT EFFORTS IN ASIA AND IN

MANAGEMENT EFFORTS IN ASIA AN THE PACIFIC, Philippines Univ., Diliman, Quezon City. For primary bibliographic entry see Field 6B. W87-00092

RIVERS OF SOUTHEAST ASIA: THEIR REGIME, UTILIZATION AND REGULATION.

A. Volker.

IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodety and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
127-138, 9 fig. 5 ref.

Descriptors: *Rivers, *Asia, *Water use, *Water management, Rainfall, Agricultural watersheds, Rainfall-runoff relationships, Water availability, Irrawaddy River, Burma, Mekong River, Chao Phya River, Thailand, Red River, Vietnam.

Phys River, Thailand, Red River, Vietnam.

Southeast Asia is a region with copious rainfall, large rivers and a high population density. The population is concentrated in the lower river valleys and deltas where lowland rice, the staple diet is produced. Therefore river flooding and high rainfall play an important role in agricultural water supply. The annual average per capita volume of water available is 4,000 cu m, which is below the world average and about equal to that for Europe. The intimate relationship between man and rivers in southeast Asia is due both to these facts and to the warm climate. The paper deals mainly with the hydrological regime, utilization and possible regulation of large rivers such as the Irrawaddy (Burma), Chao Phya (Thailand), Mekong (an international river), and the Red River (Vietnam); some smaller rivers are also considered. Emphasis is given to the effects of human intervention in the river valleys and deltas on the river regime. Some of these effects are: 1) possible rise of ficod levels due to embanking, 2) possible rise of river levels due to embanking, 3) elimination of silt creating a situation where agricultural lands are being deprived of the fertilizing effect of silt, and 4) elimination of the beneficial flushing and rinsing effects of the floods removing dirt, waste products and human disposal. (See also W87-00086) (Lantz-PTT) PTT) W87-00095

EFFECTS OF DEFORESTATION ON FLOOD EFFELIS OF DEFORESTATION ON FLOOD CHARACTERISTICS WITH PARTICULAR REFERENCES TO HAINAN ISLAND, CHINA, Hydrological General Station of Guangdong Prov-ince, Guangzhou (China). For primary bibliographic entry see Field 4C. W87-00105

RUNOFF REGIME OF A TROPICAL HIGH MOUNTAIN REGION, Bern Univ. (Switzerland). Dept. of Hydrology. For primary bibliographic entry see Field 2A. W87-00111

RIVER FLOW FORECASTING THROUGH A REGRESSION MODEL: A CASE STUDY OF

THE BASEMENT COMPLEX OF WESTERN

THE BASEMENT COMPLEX OF WEST NIGERIA, Lagos Univ. (Nigeria). Dept. of Civil Enginet For primary bibliographic entry see Field 2E. W87-00121

SIMULATING FLOOD HYDROGRAPHS FROM STORM RAINFALLS IN VENEZUELA, Universidad de Los Andes, Merida (Venezuela). Inst. de Geografia. For primary bibliographic entry see Field 2E.

W87-00123

OUTFLOW SKEWNESS IN NON-SEASONAL LINEAR RESERVOIRS WITH GAMMA-DIS-TRIBUTED MARKOVIAN INFLOWS, Lancaster Univ., Bailrigg (England). Dept. of Mathematics

For primary bibliographic entry see Field 2H. W87-00158

FLOOD SAMPLES FROM A THREE-PARAME-TER LOGNORMAL POPULATION WITH HIS-TORIC INFORMATION: THE ASYMPTOTIC STANDARD ERROR OF ESTIMATE OF THE

STANDARD ERROR OF ESTIMATE OF T-YEAR FLOOD, Inland Waters Directorate, Ottawa (Ontario). For primary bibliographic entry see Field 2E. W87-00159

HYDROLOGIC RESEARCH ON COASTAL PLAIN WATERSHED OF THE SOUTHEAST-FRN UNITED STATES,
For primary bibliographic entry see Field 7A.
W87-00204

STORMWATER MANAGEMENT DETENTION POND DESIGN WITHIN FLOODPLAIN AREAS, P. H. Smith, and J. S. Cook. Transportation Research Record, No. 1017, p 31-38, 1985. 9 fig, 9 tab, 8 ref.

Descriptors: *Detention reservoir, *Flood peak, *Flood plains, *Storm water, *Construction, *Runoff, New York, Hydrographs, Return period

A stormwater detention pond was implemented by a unique approach at a construction site in Rye, New York. Encroachment of construction activities within a floodplain adjacent to the site required the development of a detention pond that was capable of controlling excess runoff from adjacent areas while providing continued floodplain storage capacity. The impacts of flooding of adjacent properties were minimized and suitable land areas for development in accordance with the intended use (corporate headquarters) were provided by this approach. Occurrence of peak flooding along the watercourse did not coincide with peak stormwater runoff from the smaller adjacent drainage area. By utilizing flood hydrograph principles and analyses developed by the Soil Conservation Service, it was possible to develop a detention pond to provide a stormwater management phase and a flood control phase. Computerized analyses were compared for pre- and postdevelopment condition using stormwater runoff and flood flow data on the basis of storms with return period frequencies of 10, 25, 50, and 100 yr. Detention pond storage is controlled by inlet pipes and outlet structures, permitting peak flows from the pond to the watercourse and peak flood flows on the watercourse to be reduced. (Rochester-PTT)

PERFORMANCE EVALUATION OF ALTER-NATE POLICIES RESERVOIR SYSTEM OPER-ATION,

Waterloo Univ. (Ontario). Valendo Circuit. (Chiadro).
J. R. Weeraratne, L. Logan, and T. E. Unny.
Canadian Journal of Civil Engineering CICEB,
Vol. 13, No. 2, p 203-212, April 1986. 4 fig. 14 tab,

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

Descriptors: *Model studies, *Water management, *Reservoirs, *Performance evaluation, Resources management, *Systems analysis, Optimization, Grand River, Canada, Flow augmentation.

Three performance criteria (reliability, resilience, and vulnerability) were applied to the operation of the Grand River multiple reservoir system in aouthern Ontario. These criteria evaluate the performance characteristics with respect to system failure, system recovery, and system vulnerability with regard to extreme failures for alternative operational policies. System robustness is used to measure the economic flexibility of system operation to adapt to uncertainties of future demand. Primarily the objective of the presentation made herein is to establish the role of these criteria in a decision-making process in the operation of the herein is to establish the role of these criteria in a decision-making process in the operation of the system. These criteria provided a comprehensive analysis of the nature of failure that occurred at control sites with the adoption of four different operational policies. Increasing the target flows resulted in reduction of the reliability and resilienresulted in reduction of the reliability and resiliency and in an increase of system vulnerability. Within the framework of an overall evaluation of system performance, the inclusion of the performance measures with the more traditional measures such as expected costs and benefits enhances the understanding of system behavior and the selection process. (Alexander-PTT)

WINDY GAP PROJECT SCADA SYSTEM, Northern Colorado Water Conservancy District, Loveland. nary bibliographic entry see Field 6A. For primar W87-00473

CENTRAL ARIZONA PROJECT SUPERVISORY CONTROL SYSTEM,
Water and Power Resources Service, Phoenix,
AZ. For primary bibliographic entry see Field 6A. W87-00474

COMPUTER MODELS IN LOWER COLORA-DO RIVER OPERATIONS, Bureau of Reclamation, Boulder City, NV. For primary bibliographic entry see Field 6A. W87-00475

TVA'S USE OF COMPUTERS IN WATER RE-SOURCE MANAGEMENT, Tennessee Valley Authority, Knoxville. Div. of Air and Water Resources. For primary bibliographic entry see Field 6A. W87-00476

LOWER MISSISSIPPI VALLEY FLOODS OF 1982 AND 1983, Walk, Hydel and Associates, Inc., New Orleans, For primary bibliographic entry see Field 2E. W87-00500

PHOSPHORUS REDUCTION FOR CONTROL OF ALGAE, OF ALGAR, GKY and Associates, Inc., Springfield, VA. G. K. Young, and K. G. Saunders. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 5, p 574-588, October 1985. 3 fig, 5 tab, 23 ref.

Descriptors: *Phosphorus removal, *Algal control, *Time series analysis, *Mathematical models, *Waster quality, Wastewater treatment, Chlorophyll, Mathematical studies, Decision making, Nonpoint pollution sources, Model studies, Nutrients, Bays, Rivers, Cost-benefit analysis, Water pollution sources.

An analysis of elasticity factors influencing algal water quality was made using time series data of water quality, streamflow records, and mathemati-cal modeling sensitivity records. A case study of the tidewater Potomac River was made to evaluate total regional and local water quality impacts asso-

ciated with waste treatment. Estimates of the partial derivatives of chlorophyll concentrations with respect to influencing factors are combined using the total differential to find output elasticities. The elasticities allow a ranking of important factors affecting advanced waste treatment decisions. The method can be applied to other sites; an analysis of the Neabsco Creek Embayment is presented. Results from this study show that the benefits of phosphorus control are small relative to the effort required to achieve such benefits measured in terms of reducing chlorophyll-a levels. In view of the dominant effect of summer streamflow, the significant uncontrollable sources of phosphorus and the unaccounted for factors influencing water quality, reevaluation of highly restrictive phosphorus control is suggested. (Geiger-PTT)

REGULATION OF THE WATER REGIME OF THE SVIR RIVER HAVING PART OF ITS FLOW DIVERTED TO THE VOLGA BASIN, V. A. Kotel'nikov, and R. A. Nezhikhovskii. Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 588-595, May 1986. 2 fig, 4 tab, 8 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 15-19, November 1985.

Descriptors: *Water level, *Withdrawal, *Hydro-electric plants, *Navigation, *Rivers, Streamflow depletion, Flow discharge, Hydroelectric power, Mathematical studies, Pumpage, Runoff.

Three streamflow regulation variants of the Svir River were examined in light of the proposed plan to divert part of the river's flow to the Volga Basin. For the most prospective streamflow regulation variant III, the monthly production of the Upper Svir hydrostation was also determined separately for the ice-free period (April-October) and winter period (November-March). In the case of runoff withdrawals of 3.5 cu km/yr, the production of the Upper Svir hydrostation will decrease winter period (November-March). In the case of runoff withdrawals of 3.5 cu km/yr, the production of the Upper Svir hydrostation will decrease by 13.8%. Using the simplified method of calculating the minimum daily water level in the lower pool of the Lower Svir hydrostation, the effect of the planned withdrawals of the river runoff on the navigation conditions within the lower 80-km stretch of the Svir to the hydrostation dam may be calculated. Using the data obtained in combination with water level data from Lake Ladoga the probability of occurrence of a situation when the minimum level of 470 cm needed for water transport cannot be provided to the lower pool of the Svir hydrostation may be calculated. Under current conditions, the minimum level required for water transport is not provided only 15% of the time when the hydrostation is operated with a nonuniform daily regime. (Geiger-PTT)

SIMULATION OF MISSOURI RIVER BED DEGRADATION, Iowa Univ., Iowa City. Inst. of Hydraulic Re-

search.
F. M. Holly, and M. F. Karim.
Journal of Hydraulic Engineering (ASCE)
JHEND8, Vol. 112, No. 6, p 497-517, June 1986. 6
fig. 1 tab, 30 ref.

Descriptors: *River beds, *River flow, *Degradation. *Simulation analysis, *Computer models, Friction, Sediments, Bottom sediments, Prediction.

Numerical simulation techniques were used to predict bed degradation in the middle Missouri River. A Total Load Transport Model was developed using the interdependence of friction factor and sediment transport. The model was implemented in a mathematical simulation model called IALLUVIAL, which computes quasi-steady water and sediment flow in natural rivers having nonuniform bed sediments. The program also incorporates bed-sediment sorting and armoring. IALLUVIAL was validated through simulation of the 1960-1980 period of severe degradation and has been used to predict 1980-2000 degradation for several river-management scenarios. Simulations indicate channelization was responsible for the degradation. (Swanigan-PTT)

W87-00628

INFLUENCE OF THE KARST SPRING SUB-MERGENCE ON THE KARST AQUIFER

Karst Water Research Inst., Trebinje (Yugoslavia). For primary bibliographic entry see Field 2F. W87-00638

MANAGING DROUGHT THROUGH TRIG-GERING MECHANISMS, Virginia Water Resources Research Center, Blacksburg. ary bibliographic entry see Field 6D.

COMPARATIVE STUDY ON PESTICIDE FOR-MULATIONS FOR APPLICATION IN RUN-NING WATERS, Technische Univ. Muenchen, Freising (Germany, F.R.). Lehrstuhl fuer Oekologische Chemie. M. Bahadir, and G. Pfister. Ecotoxicology and Environmental Safety

Ecotoxicology and Environmental Safety EESADV, Vol. 10, No. 2, p 197-201, October 1985. 4 fig, 6 ref.

Descriptors: *Aquatic weed control, *Herbicides, Pesticides, Running waters, Monolinuron, Desmetryne, Carbofuran, Aquatic plants, Aquatic weeds,

Release rates into water of monolinuron, desmetryne, and carbofuran from three different types of formulations have been studied to control aquatic weeds in running waters. The migration of active ingredients (AI) from conventional wettable powder formulations was complete within 1 day, while the migration from ethylene-vinyl acetate copolymetric matrix (EVA) lasted significantly longer due to low diffusion coefficients of monomeric pesticides in polymetric matrices D sub o = 1 x 10 to the minus 8th power to 1 x 10 to the minus 12th power/sq cm/sec. The herbicidal action could be extrapolated up to several years. Release duration of AI from calcium alginate beads lasted 2 weeks. Herbicidal effectiveness of terbutyne-EVA formulation has been investigated in alboratory-scale simulated flow system device with duckweed plants (Lemna minor) as test organism. Growth inhibition of duckweed could be achieved at approx 20 ppb terbutryne in steady state. (Author's abstract) W87-00665

WATER SUPPLY SYSTEM MODELS WITH CAPACITY EXPANSION,
International Development Center of Japan, Tokyo. For primary bibliographic entry see Field 5F. W87-00741

IMPROVING PERFORMANCE OF IRRIGA-TION/HYDRO PROJECTS. Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.

REGIONAL SKEW WITH WEIGHTED LS RE-GRESSION, Geological Survey, Reston, VA. For primary bibliographic entry see Field 2E. W87-00750

W87-00749

FLOOD CONTROL BENEFITS REVISITED, Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 6F.
W87-00753

COLLIFORD DAM SAND WASTE EMBANK-MENT AND ASPHALTIC CONCRETE MEM-BRANE, ary bibliographic entry see Field 8A.

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Groundwater Management—Group 4B

IDENTIFICATION OF HOMOGENEOUS RE-GIONS FOR FLOOD FREQUENCY ANALYSIS, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 2E. W87-0815.

CLASSIFICATION OF DRAINAGE BASINS AC-CORDING TO THEIR PHYSICAL CHARAC-TERISTICS; AN APPLICATION FOR FLOOD FREQUENCY ANALYSIS IN SCOTLAND, Saint Andrews Univ. (Scotland). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W87-00821

4B. Groundwater Management

GROUNDWATER RESOURCES: INVESTIGA-TION AND DEVELOPMENT, Hebrew Univ. of Jerusalem (Israel). Groundwater Research Center.

Research Center: S. Mandel, and Z. L. Shiftan. Academic Press, New York. 1981. A Water Pollu-tion Series Monograph. 269 p.

Descriptors: *Groundwater potential, *Ground-water management, Aquifers, Geophysics, Drill-ing, Pumping tests, Geochemistry, Isotope studies, Groundwater availability.

The advantages of groundwater as a source of water supply is an undisputed fact. An extensive literature deals with the theoretical aspects of groundwater movement, groundwater management and conservation, and other specialized aspects of the subject. The application of advanced techniques relies on the availability of data, and it is in this field that a gap is often felt. In developed regions, the required data can usually be taken from files dating back to the precomputer era. Developing regions, however, have little data to start with. Therefore, it has become an accepted practice to carry out intensive investigations by teams of specialists when large-scale groundwater start with. Therefore, it has become an accepted practice to carry out intensive investigations by teams of specialists when large-scale groundwater development is desired. The purpose of this book is to show how groundwater investigations should be conducted, using a systematic, well-directed effort. In particular, the volume advises the person in charge what to do, what to avoid, and what kind of results one can reasonably expect from the application of different techniques under specific conditions. Attempts are made to explain succinctly various useful techniques, to evaluate their advantages and limitations, and to organize them into a logical structure. The book begins with defining aquifer types and groundwater environments, continuing with: maps; geophysical methods, drilling techniques and methods; pumping tests; water level measurement; geochemical methods; environmental isotope techniques; and groundwater systems, balances, exploitation, networks, and investigations. (Lantz-PTT)

PROCEEDINGS OF THE ASSOCIATION OF GROUND WATER SCIENTISTS AND ENGI-NEERS; WESTERN REGIONAL GROUND WATER CONFERENCE. National Water Well Association, Worthington,

For primary bibliographic entry see Field 2F. W87-00049

POTENTIAL ROLE OF ARTIFICIAL RE-CHARGE IN GROUNDWATER MANAGE-MENT IN UTLAH, Utah Water Research Lab., Logan. S. A. Jenab, and C. G. Clyde. In: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 1-19, 3 fig, 2 tab, 31 ref.

Descriptors: *Artificial recharge, *Groundwater management, *Utah, Competing use, Precipitation, *Groundwater potential, Groundwater recharge, Groundwater irrigation, Groundwater mining, *Water supply development, Aquifer management.

Utah has an arid and semiarid climate with an average precipitation of 13.2 inches/year. The amount of precipitation varies widely throughout the state and ranges from over 50 inches/year in the mountains east of Salt Lake City to under 5 inches in western deserts. Utah has an area of 82,532 sq mi from which 10.5% is arable land. Thirty percent of the arable land is irrigated, and 57% could be irrigated if water was available. The municipal and industrial (M&I) water demand in Utah in the year 2000 is anticipated to increase 228% over 1960. Less than 5% of the total mean annual water inflow to Utah (Sa/74,000 acre-ft) is consumptively used by irrigation, < 5% is used for M&I purposes, 3% flows out of the state, and 91.5% is evaporated. In 1981, 66% of the total water pumped out from Utah groundwater aquifers (832,000 acre-ft) was for irrigation and 34% was for M&I use. Groundwater provides 20% of the agricultural water and 60% of the M&I water. The population and industrial growth in Utah by the year 2000 with the corresponding high water demand points to the future opportunity to conserve water by storing it underground by artificial recherge. The Utah by the year 2000 with the corresponding high water demand points to the future opportunity to conserve water by storing it underground by artificial recharge. The groundwater recharging opportunities lie in the northern areas of Alluvial Basins where aquifers are extensive and water is available. Through a sound groundwater development program, including discharging and recharging, future state water management could be improved. Guidelines for Utah groundwater recharging activities are suggested to encourage good aquifermanagement in the appropriate locations. (See also W87-00049) (Author's abstract) W87-00050

GROUND WATER RECHARGE WITH STORM-WATER COLLECTED IN PLAYA LAKI Texas Tech Univ., Lubbock. Dept. of Civil Engi-

L. V. Urban, and B. J. Claborn.

In: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 20-29, 5 fig, 4 ref.

Descriptors: *Groundwater recharge, *Playa lakes, *Storm water, Competing use, Ogallala Aq-uifer, Runoff, Infiltration, Recharge, Clays, Silting,

Bottom sediments.

Adequate water for agricultural, municipal, and industrial use continues to be a serious problem for many regions of the country; this is particularly true of the Southern High Plains region. The major source of supply in this area is the Ogallala aquifer, which experiences minimal recharge from 16-20 inches of annual rainfall. Runoff occurring from this precipitation is collected in playa lakes. These are shallow, broad depressions which occur with a frequency of 1-2/sq mi; an estimated 15,000-20,000 of the lakes are scattered over the region. The bottom of these lakes is comprised of clays and silts which prevent or retard infiltration and subsequent recharge. Many past attempts to recharge playa lake water have failed due to clogging in the bottom of pits, or clogging in the formation when direct injection has been attempted. Researchers at Texas Tech University have recently approached the problem from a different perspective. Utilizing procedures optimized by a laboratory study and employing 'wick' filters, geotextiles, and other available materials and a new method of installation in a playa lake has been undertaken. By burying the materials in shallow, sand-filled trenches in the lake bottom and covering the trenches with a thin layer of the natural clay, recharge water in significant quantities and of high quality has been obtained. This paper presents this concept of aquifer recharge utilizing playa lake water, and summarizes the results of initial field extended the properties of the destroit of the experimental system. (See also W87-00049) (Author's abstract)

HYDROGEOLOGY OF THE PORTLAND

Applied Geology, Aloha, OR. For primary bibliographic entry see Field 2F. W87-00062

FLUVIAL GEOMORPHOLOGY AND DESIGN ENGINEERING APPLIED TO WATER-SUPPLY AND SMALL HYDROPOWER PROJECT IN WEST-CENTRAL NEVADA,

J. R. Mount, and J. D. Steele.

IN: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 313-331, 7 fig. 1 tab, 2 ref.

Descriptors: *Fluvial geomorphology, *Design criteria, *Water conveyance, *Hydroelectric plants, *Nevada, Hydroelectric power, Municipal water, Water supply development, Wells, Geohy-drology, Groundwater potential.

A municipal water-supply project is being developed from water wells completed in buried alluvial channel deposits in a valley in west-central Nevada. A corollary objective of the project is the generation of electric power that would accrue from elevation drop along the pipeline route between well field and point of use. Application of principles of fluvial geomorphology and geologic mapping established potential well sites, which were ranked according to favorability of anticipated well yield and water quality. The sites that were later selected for test well drilling compromised hydrogeologic idealism with the realities of engineering feasibility and political obstacles. The sites of finished production wells will be adequate though not optimum from the standpoint of yield and water quality, yet overall an economically viable project will have been achieved. (See also W87-00049) (Author's abstract)

NEW LOOK AT THE SALT LOAD OF THE RIO SALADO, NEW MEXICO, Bureau of Indian Affairs, Albuquerque, NM. Albu-

rque Area Office. For primary bibliographic entry see Field 5B. W87-00064

PUMPING TEST OF WELL CAMPBELL ET AL. NO. 2 GILA HOT SPRINGS, GRANT COUNTY, NEW MEXICO, Summers (W.K.) and Associates, Inc., Socorro,

For primary bibliographic entry see Field 2F. W87-00081

GROUNDWATER HYDROLOGY IN AGRICUL-TURE OF THE HUMID TROPICS,

In: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Sym-posium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 241-247, 7 ref.

Descriptors: *Geohydrology, *Agriculture, *Tropical regions, Coastal aquifers, Groundwater irrigation, Leaching, Groundwater recharge, Soil water, Groundwater pollution.

Throughout virtually all of the humid tropics groundwater is a ubiquitous but modestly exploited resource. In many places it is considered a problem rather than a benefit because of waterlogging and the creation of marshes. However, agricultural effithe creation of marshes. However, agricultural efficiency can be vastly improved by using groundwater for irrigation during seasonal dry periods and throughout extended droughts. The aquifers may be classified broadly as coastal, in which fresh water exists in hydraulic connection with sea water, and interior, in which sea water is not present. The composition of the groundwater is essentially the same as in mid-latitudes. Although rates of leaching are more rapid in warm, moist climates, the final composition of groundwater is a steady state condition dependent on parent material of the soil-weathering zone and lithology of the aquifer. The rapidity and thoroughness of weathering in the humid tropics produces soils in non-deltaic areas that are poor in minerals and nutrients necessary for good plant growth. Fertilizers and

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 48—Groundwater Management

agricultural chemicals employed to compensate for this inadequacy contribute a significant load of dissolved constituents to groundwater. (See also W87-0036) (Author's abstract)

GASOLINE RESIDUAL SATURATION IN UN-SATURATED UNIFORM AQUIFER MATERI-

Connecticut Univ., Storrs. Dept. of Civil Engineering. For primary bibliographic entry see Field 5B. W87-00225

GROUNDWATER QUALITY TODAY AND TO-

Miljoeministeriet, Copenhagen (Denmark). For primary bibliographic entry see Field 5B. W87-00247

GROUNDWATER MANAGEMENT CHANCE-CONSTRAINED MODEL. Wyoming Univ., Laramie. Water Resources Re-search Inst.

search Inst.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 1, p 1-19, January 1986. 9 fig, 2 tab, 36 ref, 2 append.

Descriptors: *Groundwater management, *Model studies, *Mathematical models, *Mathematical equations, Oroundwater storage, Simulation analysis, Aquifers, Homogenous aquifers, Cooper-Jacob equation, Transmissivity.

A stochastic groundwater management model for a confined, homogeneous, and nonuniform aquifer is developed using the concept of response function developed using the concept of response function in the linear system theory. The Cooper-Jacob equation is used to develop the unit response function. The model explicitly considers the random nature of transmissivity and storage coefficient which enables the determination of optimal pumping pattern in a well field subject to a specified ing pattern in a well field subject to a specified system performance reliability requirement. A hypothetical example is utilized to demonstrate applicability of the model. Model results affected by reliability requirement and uncertainty level to aquifer parameters were examined. A post-optimality simulation is conducted to examine the performance of the model and to further assess its usefulness. (Author's abstract) W87-00736

OPTIMAL CONTROL MODEL FOR GROUND-WATER MANAGEMENT

Sutron Corp., Herndon, VA. W. H. Casola, R. Narayanan, C. Duffy, and A. B.

Bishop.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 183-197, April 1986. 5 fig, 3 tab, 26 ref.

Descriptors: *Groundwater, *Groundwater management, "Optimal control models, Water management, Model studies, Optimal development plans, Finite difference methods, Mathematical studies, Systems analysis, Aquifers.

An optimal control management model for spatial and temporal alocation of groundwater is presented. The management model integrates a physically-based finite-difference aquifer simulation model, and a linear-quadratic optimal control model. The objective functional represents present discounted benefits determined from the derived demands for irrigation water net of pumping costs. The dynamic aquifier simulation equations are directly incorporated in the optimal control model, and the cost of pumping is calculated using a drawdown correction. Aggregated parameters gotten from detailed digital model studies such as by the US Geological Survey can be used to readily calibrate the model for a particular groundwater basin. A case study application is presented to demonstrate the potential use of the model as a management tool. (Author's abstract) tool. (Author's abstract) W87-00747

CHALLENGES FOR WATER MANAGEMENT

IN TUCSON, ARIZONA, Conservation Foundation, Washington, DC. For primary bibliographic entry see Field 5G. W87-00752

HYDROLOGICAL AND HYDROGEOCHEMI-CAL METHODS FOR THE DELINEATION OF COMPLEX GROUNDWATER FLOW SYSTEMS EVIDENCED IN THE BET-SHEAN AS EVIDENCED VALLEY, ISRAEL,

Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.

For primary bibliographic entry see Field 2F. W87-00781

4C, Effects On Water Of Man's Non-Water Activities

ADVANCES IN ECOLOGICAL RESEARCH: VOLUME 12.

For primary bibliographic entry see Field 6G. W87-00039

OVERVIEW OF OIL FIELD BRINE PROB-LEMS IN THREE ILLINOIS COUNTIES.

LEMB IN THREE ILLINOIS COUNTIES.

Greater Egypt Regional Planning and Development Commission, Carbondale, IL.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-171595,

Price codes: A06 in paper copy, A01 in microfiche.

Publication No. GERPDC-82-626, November 1982. 139 p, 3 fig, 7 tab, 10 ref, 9 append. Grant No. P00-5623-01.

Descriptors: *Oil fields, *Brine, *Illinois, *Oil pollution, *Water pollution effects, Water quality, Data collections, Data interpretation, Statistical analysis, Water quality standards, Regulations, Standards, Legal aspects.

This report concludes Phase II of a two part project designed to inventory oil field brine damage and examine its potential effect on water quality. In addition, reclamation procedures used in Hamilton County, public education and legislative aspects of the brine damage problem are examined. The report gives the results of a brine damage survey in Franklin and Jefferson Counties in Southern Illinois with data tables, maps and data analysis. Descriptions are given of a four percent random sampling of sites. The report also provides a Regulatory Procedures Guide which explains enactments, rules and regulations covering Illinois enactments, rules and regulations covering Illinois oil production; gives information for processing of salt damage complaints and provides information regarding surface landowners rights in oil production areas. Public education and procedures for reclamation of brine damaged areas are also covered. (Author's abstract) W87-00048

CHANGES IN STREAMFLOW, SOLID TRANS-PORT AT THE BASIN OUTLET, AND ERO-SION ON THE SLOPES OF A SMALL TROPI-CAL FOREST BASIN AFTER CLEARCUITING CAL FOREST BASIN AFTER CLEARCUTTING
WITH HEAVY MACHINES (EVOLUTION DES
ECOULEMENTS, DES TRANSPORTS SOLIDES A L'EXUTOIRE ET L'EROSION SUR
LES VERSANTS D'UN PETIT BASSIN APRES
DEFRICHEMENT MECANISE DE LA FORET
TROPICAL HUMIDE),
Office de la Recherche Scientifique et Technique

Office de la Recherche Scientifique et Technique Outre-Mer, Cayenne (French Guiana). I.-M. Fritsch.

J. -M. Fritsch.
IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 197-214, 7 fig, 1 tab, 8 ref, 1 append.

Descriptors: *Streamflow, *Suspended solids, *Basins, *Soil erosion, *Clearcutting, Tropical regions, Forest management, Surface water.

Within the framework of a vast study of the tropical forest ecosystem in French Guiana, since 1977 the Hydrology Section of ORSTOM has undertaken experimental studies on 10 small basins. The streamflow and solid transport under the physical and climatic regime of the natural amazonian forest (annual rainfall of 3200 mm) were measured throughout two annual cycles. The basins were then clearcut using heavy machinery (tractors with tires and caterpillar tracks), in a similar way to that used by the paper industry. The results of the mechanical erosion that followed are presented. Particular reference is given to the solid transport measured at the basin outlet compared to the erosion on the slopes calculated by topographical niessureu at the basin outlet compared to the ero-sion on the slopes calculated by topographical methods. The paper discusses the changes in streamflow, discharge, solid transport and erosion during the clearcut year. (See also W87-00086) (Author's abstract) W87-00101

WATER YIELD RESULTING FROM CLEAR-CUTTING A SMALL HARDWOOD BASIN IN CENTRAL TAIWAN,

Taiwan Forestry Research Y. J. Hsai, and C. C. Koh.

T. J. Hsan, and C. C. Koh.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p
215-220, 4 fig. 2 tab, 8 ref.

Descriptors: *Clearcutting, *Water yield, *Taiwan, Hardwood, Forests, Rainfall, Net rainfall, Rainfall-runoff relationships, Water supply.

The water yield increase resulting from clearcutting a small (5.86 ha) low altitude experimental basin was studied. The basin was covered originally with subtropical montane hardwood forest and ground disturbance was kept to a minimum as akyline logging was used. The climate of the studied are a is characterized by a distinct wet (from May to September) and dry season. Rainfall during the wet season averaged 1680 mm or 82% of the annual rainfall. Based on the paired basin technique, water yield increases of 402 mm (55%) and 184 mm (47%) were estimated for the first and second wet seasons after the clearcut respectively. For two dry seasons the yield increases were 46 mm (108%) and 20 mm (293%). Although the ratios of increase were high during the dry seasons, the absolute amounts accounted for only 10% of the total annual yield. The results suggest that water yield increases after small-scale deforestation had little effect on the water supply during the dry season. (See also W87-00086) (Author's abstract) W87-00102

EFFECTS OF DEFORESTATION ON FLOOD CHARACTERISTICS WITH PARTICULAR REFERENCES TO HAINAN ISLAND, CHINA, Hydrological General Station of Guangdong Prov-ince, Guangzhou (China).

ince, Guangzhou (China).

Q. Wangcheng.

IN: Hydrology of Humid Tropical Regions, IAHS

Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the

International Union of Geodesy and Geophysics,

Hamburg, West Germany, August 15-27, 1983. p

249-257, 4 fig. 2 tab.

Descriptors: *Deforestation, *Flood characteristics, *Hainan Island, *China, Tropical regions, Rainfall-runoff relationships, Rainfall, Storm runoff, Floodwater, Flood routing, Hydrographs.

Hainan Island, the second largest island in China, has an area of 33,900 sq km and lies in a humid tropical region. In the last 30 years the forest cover has been drastically reduced from about 50 to 21%. To study the effects of deforestation on flood observed strictive trends in annual story spinfalls and 21%. To study the effects of electrestation on flood characteristics, trends in annual storm rainfalls and floods, rainfall/runoff relationships, and convergence of runoff in the water courses, are analyzed. Since deforestation should not change the atmospheric circulation, there should be no noticeable change in annual depth of storm rainfall and flood. Comparing (a) annual variations of maximum 24-hr Watershed Protection—Group 4D
287-297, 2 fig. 23 ref. oped for the state of Washington and other Pacific

precipitation and peak flow at four stations in the central hilly region where considerable deforestation has occurred, with those of eight stations in the coastal region only slightly affected by deforestations; (b) total precipitation losses at eight stations in hilly region in the 1960's with those in the 1970's; and (c) unit hydrographs for Shirang station in the 1960's with those for the 1970's for similar storm rainfalls, it may be concluded that because Hainan Island is situated in the humid topical region with heavy storm rainfall, deforestation does not affect the atmospheric circulation. Scrub grows rapidly after deforestation, therefore deforestation has no notable effect on flood characteristics. Forest plays a role in preventing soil erosion, conserving water resources, and regulating streamflow, as well as retarding storm runoff to some extent, therefore emphasis must be placed on forest conservation and afforestation. (See also W87-00086) (Lantz-PTT)

DEFORESTATION IMPACT ASSESSMENT: THE PROBLEMS INVOLVED, Liverpool Univ. (England). Dept. of Geography. M. F. Wilson, and A. Henderson-Sellers. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 274-283, 3 fig, 1 tab, 25 ref.

Descriptors: *Deforestation, *Ecological effects, *Environmental impact, Soil erosion, Soil fertility, Model studies, Climatology, Hydrologic properties, Simulation analysis.

Model studies, Climatology, Hydrologic properties, Simulation analysis.

Deforestation may result in rapid positive environmental feedbacks because of the large energies inherent in the climate system, e.g. soils are eroded and fertility declines. The relative importance of the radiative and hydrospheric feedbacks and their respective relaxation times are extremely difficult to assess. The responses of general circulation climate models seem to be very sensitive to the land surface parameterization employed. Some of the difficulties encountered by climate modellers undertaking climatic impact assessments of the removal of forest vegetation in tropical regions were investigated. This study considers the different results of climate models with varying degrees of sophistication. One of the major conclusions is that the effects of the hydrosphere, which have generally been neglected in simpler climate models and incompletely incorporated into more complex two and three dimensional models, must be adequately parameterized if realistic and useful simulations are to be produced. Results seem to suggest that the climatic effects of a surface abbedo change are smaller in a very moist atmospheric environment than in arid regions. However, attention must be drawn to the considerable range in the types of climate models applied in analysis of the impact of deforestation. These models differ considerably in the methods employed and level of sophistication of the parameterization of land surface processes. The diversity in the climatic perturbations found reflects both this range in parameterization schemes and their ability to simulate time-lagged feedback effects. These considerable differences underline the clear need to reconsider and improve the parameterization of land surface processes in climate models. Until such improvements are implemented it is unwise to draw conclusions about the possible impact upon climate of tropical deforestation. (See also W87-00086) (Lantz-PTT)

RUNOFF GENERATION IN TROPICAL RAIN-FORESTS OF NORTHEAST QUEENSLAND, AUSTRALLA, AND THE IMPLICATIONS FOR LAND USE MANAGEMENT, James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography. M. Bonell, D. A. Gilmour, and D. S. Cassells. IN: Hydrology of Humid Tropical Regions, LAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p

Descriptors: *Surface runoff, *Rain forests, *Queensland, *Australia, *Land management, Overland flow, Rainfall intensity, Saturation, Hydrology, Soil water, Rainfall-runoff relationships, Monsoons.

Monsoons.

The more important findings from runoff generation studies in the tropical rainforests of northeast Queensland, Australia are reviewed. A number of implications for land management and future research are examined. Widespread overland flow is commonly recorded in the undisturbed forest. The prevailing rainfall intensitives frequently exceed the saturated hydraulic conductivity of the profile below 0.2 m, which causes the rapid development of saturation in the top layer and the generation of overland flow. As a result no change in the runoff hydrology occurred following logging but suspended levels were doubled during high flows, while clearing produced a tenfold increase. A major problem is that the subsoil of some of the tropical soils is highly dispersible once the A horizon has been removed by logging or agriculture. Thus the frequent occurrence of overland flow and raindrop impact ensures high soil losses from sugar cane fields under monsoonal conditions. (See also W87-00086) (Author's abstract)

1983 SANTA CRUZ FLOOD: HOW SHOULD HIGHWAY ENGINEERS RESPOND, B. M. Reich, and D. R. Davis.
Transportation Research Record, No. 1017, p 1-8, 1985. 9 fig, 25 ref.

Descriptors: "Flood damage, "Highways, "Civil engineering, "Flood frequency, Flood peak, Santa Cruz River, Arizona, Cost analysis, Statistical analysis, Frequency distributions, Management planning, Bridges, Piers, Abutments, Scour, Channel morphology,

Inspection of field conditions, aerial photographs, and historical reports confirms that increased conveyance and reduced overbank flooding onto wide upstream floodplains could have produced an observed nonstationarity (increasing flood magnitudes over the last 70 yr) on the Santa Cruz River, Arizona. The most recent 27 yr of statistical data were used as a first approximation to present hydrologic conditions. Uncertainties associated with this short subrecord and progressive deterioration of the river system are considered in a systems analysis. Because of the extensive expense of rebuilding many bridges in this rapidly-expanding urban area (Tucson), it is recommended that consideration be given to confidence bands, safety factors, distributions other than the Log Pearson III, and floods observed on other Arizona watersheds within the past century in an attempt to establish a new 100-yr estimate for this 2,222 aq mi semiarid watershed. Four independent hydrologic analyses are used to estimate the 100-yr discharge near Congress Street; all suggest that 100,000 cu ft/sec is an appropriate estimate. (Rochester-PTT) W87-00202

FORECASTING POLLUTANT LOADS FROM HIGHWAY RUNOFF, For primary bibliographic entry see Field 5B. W87-00207

ASSESSING THE IMPACTS OF OPERATING HIGHWAYS ON AQUATIC ECOSYSTEMS, R. R. Horner, and B. W. Mar. Transportation Research Record, No. 1017, p 47-55, 1985. 5 fig, 4 tab, 47 ref.

Descriptors: *Highways, *Water pollution sources, *Washington, *Pacific Northwest, *Runoff, *Water quality, *Pollutant loads, Mitigation, Mathematical models, Prediction, Maintenance.

A protocol has been developed for assessing the impacts of highway operations and maintenance and determining the need for mitigation measures. The general strategy applies nationally, and the specific elements of the method have been devel-

oped for the state of Washington and other Pacific Northwest locations on the basis of comprehensive research that was conducted in that region on highway runoff water quality. The basic premise of the protocol is that the highway impact on the receiving water can be associated most realistically in the context of the aggregate burden that is created by all activities in the watershed. By using an initial screening process a determination can be made as to whether or not a case is likely to have an insignificant impact. Substantial resources then are expended on assessing only those cases thay may have a significant impact on aquatic ecosystems. Such cases are subjected to analyses of both cumulative pollutant loadings and changes in pollutant concentrations in the receiving waters, which emphasize the most critical conditions under the circumstances. Mitigation is considered in both steps. The Washington results were employed to develop a deterministic model for the pollutant loading analysis and a probabilistic procedure for the pollutant concentration assessment. The protocol offers opportunities to forecast potential aquatic impacts of a highway at an early stage of project development and to allocate mitigation measures on the basis of need. (Rochester-PTT)

CONSEQUENTIAL SPECIES OF HEAVY METALS IN HIGHWAY RUNOFF, For primary bibliographic entry see Field 5B. W87-00205

RECOVERY OF PREVIOUSLY ACIDIFIED LAKES NEAR CONISTON, CANADA FOL-LOWING REDUCTIONS IN ATMOSPHERIC SULPHUR AND METAL EMISSIONS, Toronto Univ. (Ontario). Inst. for Environmental Studies.

For primary bibliographic entry see Field 5G. W87-00335

RESEARCH NEEDS IN URBAN STORM-WATER POLILUTION, Florida Univ., Gainesville. Dept. of Environmental Engineering. For primary bibliographic entry see Field 5G. W87-00738

4D. Watershed Protection

RESUSPENSION POTENTIAL OF DEPOSIT-ED COHESIVE SEDIMENT BEDS, Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering. For primary bibliographic entry see Field 2L. W87-00025

SEDIMENT CONTROL THROUGH DREDG-ING, Corps of Engineers, Atlanta, GA. For primary bibliographic entry see Field 8C. W87-00030

RIVERS OF SOUTHEAST ASIA: THEIR REGIME, UTILIZATION AND REGULATION, For primary bibliographic entry see Field 4A. W87-00095

INTERPRETATION OF THE SEDIMENTOLO-GICAL BEHAVIOUR OF THE TOCANTINS-ARAGUAIA BASIN, Elemonte/Hidroesb S.A., Rio de Janeiro (Brazil). For primary bibliographic entry see Field 2J. W87-0096

SOIL EROSION IN THE HUMID TROPICS WITH PARTICULAR REFERENCE TO AGRICULTURAL LAND DEVELOPMENT AND SOIL MANAGEMENT, International Inst. of Tropical Agriculture, Ibadan (Nigeria).

R. Lal.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4D—Watershed Protection

IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Sym-posium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 221-239, 8 fig. 8 tab, 54 ref.

Descriptors: *Soil erosion, *Tropical regions, *Land development, *Soil management, *Agriculture, Humid areas, Forest management, Agronomy, Nigeria, Water conveyance, Agricultural hydrology.

This report reviews the problem of soil erosion on arable lands in the humid tropics and its relation to deforestation and land development and to soil and crop management practices. It also discusses the problem of evaluating acceptable rates of soil erosion in relation to the rate of weathering and of new soil formation and to the soil erosion-crop productivity relationship. Soil erosion in the humid tropics increases drastically when the protective forest cover is removed. One reason for this increase is that intense rainstorms of high energy load occur commonly in the reigon. Erosion is generally most severe in the first year after land clearing. After the soil has stabilized, erosion depends more on postclearing soil management than on the methods of land clearing. Field experiments conducted in southwestern Nigeria and elsewhere in the tropics indicate that mechanical land clearing causes more by the type of attachment used. in the tropics indicate that mechanical land clearing causes more by the type of attachment used.
Agronomic practices that conserve the soil include
mulch farming, no-till systems, mixed cropping
with multistorey canopy structure, and appropriate
crop rotations with frequent use of cover crops
and planted fallows. Engineering practices such as
tied ridges, graded channel terraces, diversion
channels, and grassed waterways are less effective
than improved soil management practices. These
engineering practices also require regular maintenance and are fairly expensive. (See also W870086) (Lant-PTT) 00086) (Lantz-PTT) W87-00103

STATISTICAL ANALYSIS OF BANK EROSION AND CHANNEL MIGRATION IN WESTERN CANADA,

Wollongong Univ. (Australia). Dept. of Geography. For primary bibliographic entry see Field 2J. W87-00227

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

LEACHING OF LIGNITE ASH BY RAIN AND ACID RAIN, Texas Tech Univ., Lubbock.

R. A. Bartsch.

R. A. Bartsch.
Available from the National Technical Information
Service, Springfield, VA. 22161, as DE83-900691,
Price codes: A02 in paper copy, A01 in microfiche.
Report No. TENRAC/EDF-046, August 25,
1981. 15 p, 5 tab, 15 ref. Project 80-L-11-1.

Descriptors: *Leaching. *Lignite ash, *Rain, *Acid rain, Jourdanton, Texas, Demineralized water, Inorganic compounds, Cadmium, Cobalt, Copper, Lead, Manganese, Nickel, Silver, Zinc, Hydrogen ion concentration, San Miguel Electric

Samples of lignite ash were obtained from the start-up operations of the San Miguel Electric Cooperative Power Station at Jourdanton, Texas. Fly ash and bottoms ash were subjected to the conditions of a 'worst case analysis' by refluxing with demineralized water in order to determine the demineratized water in order to determine the maximum concentrations of hazardous inorganic pollutants which could be leached from the ash samples. The leachate was analyzed for cadmium, cobalt, copper, lead, manganese, nickel, silver, and zinc. Effects of varying the pH of the leaching water most the concentrations of these species in water upon the concentrations of these species in the leachate were also assessed. For the fly ash, the

concentrations of cadmium, cobalt, lead, nickel, and silver in the fly ash leachate were lower than the detection limits of the analytical techniques at all pH values. Zinc was detectable at all pH levels studied, and copper and manganese were detected at the most acidic pH levels. At all pH values willived, the concentrations of cadmium, cobalt. at the most acidic pH levels. At all pH values utilized, the concentrations of cadmium, cobalt, copper, lead, and silver in the bottom ash leachate were below the detection limits of the analytical technique. Cobalt, manganese, nickel, and zinc were detected at most pH values. The results indicate that the exhaustive leaching of the fly and bottoms ash from the combustion of Texas lignite does produce concentrations of some hazardous inorganic constituents which are in the range of inorganic constituents which are in the range of hundredths to tenths of a part per million. (Author's abstract) W87-00003

BIOCHEMICAL CORRELATES OF STRUCTURE AND STABILITY IN DIVERGENT PLANKTON COMMUNITIES,

Rhode Island Univ., Kingston. Graduate School of

Cocanography.

H. P. Jeffries, and R. M. Lambert.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 91-101, 3 fig., 4 tab, 28 ref. DOE Grant No. DE-AC02-78EV04941.

Descriptors: *Biochemical analysis, *Plankton communities, *Ecological stability, *Macrozoo-plankton, Rhode Ialand Sound, Narragansett Bay, Saline water, Biomass, Chlorophyll a, Wastewater, Doccosahexaenoic acid, Stearic acid, Fatty acids, Rhode Island, New Foundland, Ecosystem.

Fatty acid composition of macrozooplankton (>240 micrometers) revealed responses specific to habitat type along a transect extending from Rhode Island Sound to the inner reaches of Narragansett Bay. A medium chain saturate (stearic acid) characterized riverine zooplankton, a direct response to foods rich in natural detritus and raw sewage. A long chain polyunsaturate (docosahexaenoic acid) denoted affinities in tissue composition more genetically determined than environmentally based. Zooplankton biomass and chlorophyll a concentrations over two summers varied in relation to the same two acids, indicating an association to the same two acids, indicating an association to the same two acids, indicating an associa-tion between structure at the chemical level and tion between structure at the chemical level and function within the ecosystem. A discriminant function based on these two acids clearly separated estuarine from offshore macrozooplankton. Compared with published data, these results suggest that zooplankton contains more stearic acid and less docoashexaenoic acid in European waters (North Sea, Rias of Northwest Spain, Mediterranean Sea) than in comparable areas of Rhode Island and New Foundland. Within the Rhode Island area, tendency to change consistently (stability) and reew roundising. Within the Khode Island area, tendency to change consistently (stability) increased in the order of physical environment, planktonic community, and biochemical composition. Thus, not only are fatty acids ubiquitous in nature and especially important energetically in zooplankton, but dynamically these monomeric compounds are also most conservative. Consequently, they serve well in comparative study at various levels of natural organization. (See also W87-00005) (Author's abstract)

TECHNICAL BACKGROUND INFORMATION FOR THE ENVIRONMENTAL AND SAFETY REPORT, VOL. 5: THE 1977 CLINCH RIVER SEDIMENT SURVEY - DATA PRESENTA-

Oak Ridge National Lab., TN. For primary bibliographic entry see Field 5B. W87-00047

DIRECT MEASUREMENT OF ATP AND ADE-NINE NUCLEOTIDE POOL TURNOVER IN MICROORGANISMS: A NEW METHOD FOR ENVIRONMENTAL ASSESSMENT OF ME-TABOLISM, ENERGY FLUX AND PHOSPHO-

RUS DYNAMICS,
Hawaii Univ., Honolulu. Dept. of Oceanography.
For primary bibliographic entry see Field 2H.

W87-00163

ISOLATION OF INDIGENOUS WASTEWATER BACTERIAL STRAINS CAPABLE OF MOBI-LIZING PLASMID PBR325,

Drexel Univ., Philadelphia, PA. Dept. of Bioscience and Biotechnology. P. McPherson, and M. A. Gealt.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 5, p 904-909, May 1986. 2 fig. 7 tab, 14 ref. EPA Grant No. R810049-01.

Descriptors: *Pollutant identification, *Fate of pollutants, *Separation techniques, Enterobacter, Escherichia coli, Klebsiella, Wastewater treatment, Culturing technique.

The consequences that might result from the intro-duction of microorganisms containing genetically engineered DNA sequences (GEDS) into natural environments will depend in part on the stability of the GEDS introduced into the bacterium. In the present study, indigenous mobilizers, capable of mobilizing pBR325 plasmid into an indigenous wastewater recipient were isolated from raw wastewater, identified, and characterized with re-spect to their plasmid content and antibiotic resist-ance. Several strains possessing both antibiotic resistance and high-molecular-weight plasmids trans-ferred their resistance characteristics to recipient cells during a 25 hr coincubation period. Eight strains were characterized (six Bscherichia coli and two Klebsiella pneumoniae); each produced 100 to 10 to the 7th power transconjugants per ml by the two Klebsiella pneumoniae); each produced 100 to 10 to the 7th power transconjugants per ml by the end of the incubation period. They were also able to mobilize pBR325 from a laboratory strain of E. coli into plasmid-free recipients to yield 100 to 10 to the 7th power transconjugants per ml. These transconjugants possessed phenotypic characteristics specified by pBR325, the R plasmid, and the chromosome of the recipient. Many transconjugants exhibited recombinational rearrangements of the acquired plasmid material. (Geiger-PTT) W87-00167

VARIABLES AFFECTING TWO ELECTRON TRANSPORT SYSTEM ASSAYS,

Texas Univ. at Dallas, Richardson. Inst. for Envi-ronmental Sciences.

G. A. Burton, and G. R. Lanza.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 5, p 931-937, May 1986. 2 fig, 5 tab, 36 ref.

Descriptors: *Microbiological studies, *Bioassays, *Microorganisms, *Sediments, *Dehydrogenase, Respiration, Bacteria, Culturing techniques, Separation techniques, Assays, Metabolism, Watersheds, Pollutant identification.

sheds, Pollutant identification.

Electron transport system (ETS) activity provides a relative determination of microbial community metabolic activity. Several methodological variables were found to be critical in two commonly used ETS activity assays. The dehydrogenase assay based on triphenyl formazan production exhibited a nonlinear relationship between formazan production (dehydrogenase activity) and sediment dilution, and linear formazan production occurred for 1 hr in sediment slurries. Activity decreased with increased time of sediment slurries. Activity decreased with increased time of sediment storage at 4 degrees. Extraction efficiencies of formazan from sediment varied with alcohol type; methanol gave poor recovery of formazan. Phosphate buffer (0.06 M) produced higher ETS activity than dideither U.S. Environmental Protection Agency reconstituted hard water or Tris buffer sediment intracellular formazan crystals were dissolved within minutes when in contact with immersion oil. Greater crystal production which was indicative of respiration in the community and was detected by a production which was indicative of respiration in the community and was detected by a tetrazolium salt assay occurred at increased substrate concentrations. Test diluents containing macrophyte exudates produced greater ETS activity than did phosphate buffer, U.S. Environmental Protection Agency water, or ultrapure water di-

WATER QUALITY MANAGEMENT AND PROTECTION—Field &

Identification Of Pollutants-Group 5A

luents. Both assays showed decreases in sediment or bacterial activity through time. (Geiger-PTT) W87-00169

COMPARISON OF MEMBRANE FILTER, MULTIPLE-FERMENTATION-TUBE, AND PRESENCE-ABSENCE TECHNIQUES FOR DETECTING TOTAL COLIFORMS IN SMALL COMMUNITY WATER SYSTEMS, Dartmouth Medical School, Hanover, NH. Dept.

Dartmouth Medical School, Hanover, NH. Dept. of Microbiology.

N. J. Jacobs, W. L. Ziegler, F. C. Reed, T. A. Stukel, and E. W. Rice.
Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 5, p 1007-1012, May 1986.

Z fig. 6 tab, 25 ref. EPA Cooperative Agreement No. CR-810805.

Descriptors: *Pollutant identification, *Coliforms, *Membrane filters, *Fermentation, *Drinking water, Bacteria, Water analysis, Culture media, Culturing techniques, Wells.

Methods for detecting total coliform bacteria in drinking water were compared using 1,483 different drinking water samples from 15 small community water systems in Vermont and New Hampshire. The methods included the membrane filter (MF) technique, and the presence-absence (P-A) test. Each technique was evaluated using a 100-ml drinking water sample. Of the 1,483 samples tested, 336 (23%) contained coliforms as indicated by either one, two, or all three techniques. The FT detected 82%, the P-A detected 88%, and the MF detected 64% of these positives. All techniques simultaneously detected 55% of the positives. Evaluation of the confirmation efficiency of the P-A technique showed coliforms were identified from the 37 tests in which the P-A was positive but the MF and FT were negative. The P-A test was simple to inoculate and interpret and was considerably more sensitive than the MF in detecting coliforms in this type of drinking water supply. (Author's abstract) W87-00170 Methods for detecting total coliform bacteria in

RECOVERY AND DIVERSITY OF HETERO-TROPHIC BACTERIA FROM CHLORINATED DRINKING WATERS,
Washington Univ., Seattle. Dept. of Microbiology

and Immunology.

J. S. Maki, S. J. La Croix, B. S. Hopkins, and J. T.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 5, p 1047-1055, May 1986. 4 fig, 6 tab, 25 ref. EPA Cooperative Agreement NO. CR807570010.

Descriptors: *Pollutant identification, *Heterotrophic bacteria, *Drinking water, *Chlorination, *Separation techniques, Microbiological studies, Bacteria, Sampling, Bacterial analysis, Culture media, Culturing techniques, Species diversity,

Heterotrophic bacteria were enumerated from the Seattle drinking water catchment basins and distribution system. The highest bacterial recoveries were obtained by using a very dilute medium containing 0.01% peptone as the primary carbon source. Other factors favoring high recovery were the use of incubation temperatures close to that of the habitat and an extended incubation (28 days or longer). Total bacterial counts were determined by using acridine orange staining. With one exception, all acridine orange counts in chlorinated reservoir water, indicating that chlorination often reduces the number of acridine orange-detectable bacteria. Source waters had higher diversity index values than did samples examined following chlorination and storage in reservoirs. Shannon index values based upon colony morphology were in excess of and storage in reservoirs. Shannon index values based upon colony morphology were in excess of 4.0 for prechlorinated source waters, whereas the values for final chlorinated tap waters were lower than 2.9. It is not known whether the reduction in diversity was due solely to chlorination or in part to other factors in the water treatment and distribution system. For the enumeration of heterotrophic bacteria in drinking waters, it was recom-

mended that R2A medium be used, spread plating be performed, large petri dishes be used for samples containing low concentrations of bacteria, incubation temperatures be no more than 10 degrees above the temperature of the sampling water, rapid biomass estimating procedures be used, and studies be conducted to ascertain the effects of chlorination. (Geiger-PTT) W87-00171

NITRATE REDUCTASE: AN IMPROVED ASSAY METHOD FOR PHYTOPLANKTON, Tel-Aviv Univ. (Israel). Dept. of Bioche A. Hochman, A. Nissany, D. Wynne, B. Kap

Journal of Phytoplankton Research JPLRD9, Vol. 8, No. 2, p 385-392, March, 1986. 2 fig, 3 tab, 19

Descriptors: *Phytoplankton, *Nitrate, *Enzymes, *Assays, *Bioassays, Algae, Hydrogen ion concentration, Water temperature, Eutrophication, Aquatic populations, Israel, Lake Kinneret, River Jordan, Mediterranean Sea.

A new assay for measuring the activity of nitrate reductase in phytoplankton, based upon permeability of cells treated with toluene to substrates and products, is described. The method is simple and, since the reaction is carried out directly on a glass fiber filter, can be easily performed in the field or on shipboard. In comparison with previous methods, this technique gave higher absolute amounts of NO2(-) formed per unit and higher enzymatic activities per sample volume when tested with axenic algal cultures and with natural phytoplankton populations from Lake Kinneret, the River Jordan and the Eastern Mediterranean. (Author's abstract) abstract) W87-00186

DETERMINATION OF GLYPHOSATE HERBI-CIDE AND (AMINOMETHYL)PHOSPONIC ACID IN NATURAL WATERS BY LIQUID CHROMATOGRAPHY USING PRE-COLUMN FLUOROGENIC LABELING WITH 9-FLUOR-ENYLMETHYL CHEOROFORMATE,

Florida Univ., Gainesville. Dept. of Food Scier and Human Nutrition.

and Human Nutrition.

C. J. Miles, L. R. Wallace, and H. A. Moye.

Journal of the Association of Official Analytical
Chemists JANCA, Vol. 69, No. 3, p 458-461, May/
June 1986. 3 fig. 2 tab, 13 ref. U.S. Forest Service
Contract PNW-83-306.

Descriptors: *Pollutant identification, *Glyphosate herbicide, *Aminomethyl phosphonic acid, *Liquid chromatography, *Fluorenylmethyl chlor-oformate, Pre-column fluorgenic labeling, Rotary evaporation, Chemical analysis.

evaporation, Chemical analysis.

An analytical method was developed for the determination of glyphosate herbicide and its major metabolite (aminomethyl)phosphonic acid (AMPA), in natural waters. Sample pretreatment consisted of filtration, addition of phosphate buffer, concentration by rotary evaporation, and a final filtration before derivatization with 9-fluorenylmethyl chloroformate. The derivatives were separated by anion exchange liquid chromatography and measured with a fluorescence detector. Standard curves were linear over three orders of magnitude and minimal detectable quantities were 10 nanogram/ml for glyphosate and 5 nanogram/ml AMPA. The 20-fold concentration factor realized in the sample preparation corresponds to ppb method detection limits for glyphosate and AMPA in natural waters. Recovery and storage studies were performed and are discussed. (Author's abstract) stract) W87-00212

DETERMINATION OF HALOGENATED PHENOLS IN RAW AND POTABLE WATER BY SELECTED ION GAS CHROMATOGRA-PHY-MASS SPECTROMETRY,
Environmental Health Directorate, Ottawa (Ontar-

. B. Sithole, D. T. Williams, C. Lastoria, and J. L.

Journal of the Association of Official Analytical Chemists JANCA, Vol. 69, No. 3, p 466-473, May/ June, 1986. 4 fig, 5 tab, 26 ref.

Descriptors: *Halogenated phenols, *Potable water, *Ion gas chromatography, *Mass spectrometry, Phenol, Water analysis, Pentachlorophenol, Trichloroguaiscol, Raw water, Electron capture detector, Canada.

Pentafluorobenzylation and in situ acetylation were compared in the determination of phenol and halogenated phenols in water samples. The latter technique is considered superior to the former for determination of phenols at the nanogram/liter level because of less background interference and better recoveries (80% or better except for pentachlorophenol and trichloroguaiscol, which had recoveries of about 60%). Further evaluation of the in situ technique by electron capture (ECD) recoveries of about 60%). Further evaluation of the in situ technique by electron capture (BCD) gas chromatography (GC) and GC-mass spectrometry (MS) showed that the latter, in the selected ion monitoring mode, was more suitable because, unlike ECD-GC, it could confirm and quantitate all phenols. In particular, ECD-GC could not detect even high levels of phenol and the monohalogenated phenols. Phenols at 5-473 nanogram/liter were detected in some Canadian drinking water supplies by the in-situ acetylation technique combined with GC-MS. (Author's abstract) W87-00213

ANALYSIS OF PHOTOSYNTHESIS IN AIR AND WATER OF ASCOPHYLLUM NODOSUM (L.) LE JOL,

Dundee Univ. (Scotland). Dept. of Biological Sci-

For primary bibliographic entry see Field 2L. W87-00220

IDENTIFICATION OF ARSENOBETAINE AND ARSENOCHOLINE IN CANADIAN FISH AND SHELLFISH BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH ATOMIC ABSORPTION DETECTION AND CONFIRMATION BY FAST ATOM BOMBARDMENT MASS SPECTOMETRY,

Health and Welfare Canada, Ottawa (Ontario). Food Research Div.

For primary bibliographic entry see Field 5B.

MONITORING NATURAL WATERS FOR DRINKING-WATER QUALITY,

National Water Research Inst., Burlington (Ontar-

World Health Statistics Quarterly, Vol. 39, No. 1, p 32-45, 1986. 1 fig, 5 tab, 5 ref.

Descriptors: *Diseases, *Drinking water, *Monitoring, *Global Environmental Monitoring System, International agreements, Networks.

The nature of waterborne diseases and the consideration of water as a finite resource are outlined; the objectives, organization, and operation of the Global Environmental Monitoring System for Water (GEMS/Water) are described; and the water quality data that have been gathered by the GEMS/Water program are critically reviewed. Three years is too short a time to draw any conclusions about long-term incidence and trends in water pollution and that the quarter of a million data points reported so far from some 450 monitoring sites in 60 countries represent only a fraction of the data needed for meaningful interpretation, but that a beginning has been made. More than half the countries participating in the GEMS/Water project have never had their own national water project have never had their own national water quality monitoring programs. By designating a center or a laboratory as the focal point of the GEMS/Water program, each country is laying the foundations for the establishment or future expansion of its own national water quality monitoring network. (Rochester-PTT)

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

LABORATORY PERFORMANCE EVALUA-TION STUDIES AND THEIR RELATIONSHIP TO THE GLOBAL ENVIRONMENTAL MONI-TORING SYSTEM IN WATER (GEMS/

ironmental Monitoring and Support Lab.-Cin-ati, OH. Quality Assurance Branch.

P.W. Britton. World Health Statistics Quarterly, Vol. 39, No. 1, p 46-57, 1986. 1 fig. 4 tab, 8 ref.

Descriptors: *Global Environmental Monitoring System, *Environmental Monitoring and Support Laboratory, *Performance evaluation, *Laborato-ries, *Chemical analysis, *Statisical analysis, *Re-gression analysis, Environmental Protection

Statistical considerations important in comparing the U.S. Environmental Protection Agency's (USEPA) Environmental Monitoring and Support Laboratory (EMSL) to the Global Environmental (USEPA) Environmental Monitoring and Support Laboratory (EMSL) to the Global Environmental Monitoring System (GEMS) are discussed. A description of USEPA laboratory performance evaluation studies, the basis of limits in USEPA water laboratory performance evaluation studies including estimating study statistics from the current study and estimating study statistics using regressions on previous statistics), and performance evaluation studies involving GEMS/Water and a comparison of GEMS1 limits and USEPA limits are included. The author states that limits for USEPA studies appear to account more completely for the effect of analyte and concentration differences than did the limits used for evaluation of the GEMS 1 data. Furthermore, failure to produce data within USEPA limits is less a factor of which analyte or sample a participant reports and more a factor of true performance. Accordingly, there is a case for GEMS/Water considering statistically-based limits for future laboratory performance evaluation studies. (Rochester-PTT) W87-00244

ISOLATION OF NON-O1 VIBRIO CHOLERAE SEROVARS FROM SURFACE WATERS IN WESTERN COLORADO,

Colorado State Univ., Grand Junction. Fruita Re-search Center.

J.B. Rhodes, H.L. Smith, Jr., and J.E. Ogg.
Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 6, p 1216-1219, June 1986.
1 fig. 1 tab, 27 ref.

Descriptors: *Cholera, *Colorado, *Surface water, *Salinity, Toxicity, Mouse adrenal cells, Rivers, Creeks, Washes, Irrigation canals, Ditches.

Non-O1 Vibrio cholerae was isolated from rivers, Non-Ol Vibrio cholerae was isolated from rivers, creeks, washes, irrigation canals, and ditches in western Colorado (Mesa County) during the summer of 1985. The organism occurred in fresh water (< or = 5 mmol of Na(+) per liter) as well as in water of higher salinity (approx 17 mmol of Na(+) per liter). Sixteen serovars of non-Ol V cholerae were identified among the environmental isolates. All of the isolates were cytotoxic to Y-1 mouse adrenal cells. The results of the present study tend to surport earlier suspensions that nonstudy tend to support earlier suggestions that non-Ol V cholerae may indeed be indigenous to the aquatic environment in parts of western Colorado. (Rochester-PTT) W87-00256

RECOVERY OF VIRUSES FROM WATER BY A MODIFIED FLOCULATION PROCEDURE FOR SECOND-STEP CONCENTRATION, Environmental Monitoring and Support Lab.-Cincinnati, OH. Biological Methods Branch. D. R. Dahling, and B.A. Wright.
Applied and Environmental Microbiology
AEMIDF, Vol 51, No. 6, p 1326-1331, June 1986.
4 fig. 3 tab, 20 ref.

Descriptors: "Viruses, "Powdered beef extract, "Celite filter aid, "Silicate, "Microbial analysis, "Organic flocculation procedure, Performance evaluation.

A reduction in virus (poliovirus 1, echovirus 7, coxsackievirus A9) recovery efficiencies stemming

from a change in the commercial processing of powdered beef extract was reversed by the addi-tion of Celite analytical filter aid. Supplementing beef extract with this silicate is recommended as a beef extract with this silicate is recommended as a modification to the organic flocculation procedure for second-step concentration in monitoring for waterborne viruses. Considerable differences in virus recovery were found among lots of beef extract and Celite preparations; this indicates that the performance of each lot of these substance should be checked before use. (Author's abstract) W87-00260

TITRATION OF SULPHIDES AND THIOLS IN

NATURAL WATERS, Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemis-

For primary bibliographic entry see Field 2K. W87-00264

PRECONCENTRATION BY DITHIOCARBA-MATE EXTRACTION FOR DETERMINATION OF TRACE ELEMENTS IN NATURAL WATERS BY INDUCTIVELY-COUPLED PLASMA ATOMIC EMISSION SPECTROME-Kyoto Univ., Uji (Japan). Inst. for Chemical Re-

For primary bibliographic entry see Field 2K. W87-00265

DETERMINATION OF THALLIUM IN SEDI-MENTS AND NATURAL WATERS, Liverpool Univ. (England). Dept. of Oceanogra-

phy. For primary bibliographic entry see Field 2K. W87-00266

CHEMICAL DERIVATIZATION ANALYSIS OF PESTICIDE RESIDUES. X. ANALYSIS OF TEN ACID HERBICIDES IN NATURAL WATERS, Canada Centre for Inland Waters, Burlington (On-

H-B. Lee, Y.D. Stokker, and A.S.Y. Chau Journal of the Association of Official Analytical Chemists JANCA, Vol. 69, No. 3, p 557-560, May/ June 1986. 2 fig, 3 tab, 14 ref.

Descriptors: *Derivatization analysis, *Herbicides, *Gas chromatography, *Acid herbicides, *Chemical analysis, Electron capture detector, Pentafluorbenzyl bromide, Piclora

An improved and augmented gas chromatographic (GC) method using a capillary column and electron capture detector was developed for determination of 10 common acid herbicides in natural water. The herbicides were extracted with methylene chloride after the water sample was acidified to pH < 1. Concentrated extracts in acetone were derivatized with pentafluorobenzyl bromide (PFBBr) to form the corresponding PFB esters. Derivatives were cleaned up on a deactivated silica gel column. A SE-34 fused silica capillary column was used to separate and identify the products. Using this procedure, the method was successfully validated for herbicide concentrations as low as 0.05 microgram/liter in natural waters. Recoveries of water samples fortified with the 10 herbicides ranging from 1.0 to 0.05 microgram/liter were 73 to 108% with the exception of picloram, which was only 59% recovered at 0.1 microgram/liter. (Author's abstract) water. The herbicides were extracted with methyl-

ACCUMULATIVE SAMPLING OF TRACE PES-TICIDES AND OTHER ORGANICS IN SUR-FACE WATER USING XAD-4 RESIN, California Univ., Davis. Dept. of Environ Toxicology, M. A. Majewski, and J. N. Seiber. J. E. Woodrow, M. A. Majewski, and J. N. Seiber. Journal of Environmental Science and Health JPFCD2, Vol. 1321, No. 2, p 143-164, 1986. 4 tab,

Descriptors: *Pollutant identification, *Pesticides, *Rivers, Chlorophenol, Solvent Extraction, Nitro-

gen compounds, Organochlorine pesticides, Organophosphorus pesticides, Gas chromatography, Liquid chromatography, Sampling.

Liquid chromatography, Sampling.

The development of an accumulative method for use in sampling surface waters, and particularly river water, for selected trace organic pesticides and other pollutants was examined. XAD-4 resin accumulative sampling was tested as a means of on-site extraction of surface waters. Recoveries for most organochlorine, organophosphorus, organonitrogen, chloropheno), and chlorophenoy acid pesticides and related pollutants were acceptable when spiked at the 10 and 0.1 ppb levels. Detection limits of 1-100 ptt were attainable for most compounds in river water, although lower levels required the use of a high pressure liquid chromatography cleanup/fracionation step prior to those gas chromatography determinations using electron capture detection. XAD-4 accumulative sampling was competitive with solvent extraction of grab samples in terms of recoveries, and was advantageous with respect to volume of water samples, detection limits, and sample handling. The wide range of solutes applicability combined with the ease of constructing and operating the accumulative sampler recommends it over grab sampling for many types of monitoring applications. (Peters-PTT) W87-00274

PALEOEPIDEMIOLOGIC INVESTIGATION
OF LEGIONNAIRES DISEASE AT WADSWORTH VETERANS ADMINISTRATION
HOSPITAL BY USING THREE TYPING
METHODS FOR COMPARISON OF LEGIONELLAE FROM CLINICAL AND ENVIRONMENTAL SOURCES,

Veterans Administration Wadsworth Medical Center, Los Angeles, CA. P.H. Edelstein, C. Nakahama, J.O. Tobin, K. Calarco, and K.B. Beer.

Journal of Clinical Microbiology JCMIDW, Vol. 23, No. 6, p 1121-1126, June 1986. 4 tab, 22 ref.

Descriptors: *Paleoepidemiology, *Wadsworth Veterans Administration Hospital, *Enzyme elec-trophoresis, *Monoclonal antibodies, *Plasmids, Potable water, Cooling water, Chlorination, Epi-demiology, Los Angeles, California.

demiology, Los Angeles, California.

Multiliccus enzyme electrophoresis, monoclonal antibody typing for Legionella pneumophila serogroup 1, and plasmid analysis were used to type 89 L pneumophila strains isolated from nosocomial cases of Legionnaires disease at the Veterans Administration Wadsworth Medical Center (VAWMC, Los Angeles) and from the hospital environment. Twelve L pneumophila clinical isolates, obtained from patients at non-VAWMC hospitals, were also typed by the same methods. Most (79%) of 33 VAWMC L pneumophila serogroup 1 clinical isolates and 70% of 23 environmental isolates were found in only one of the five monoclonal subgroups. Similar clustering was found for the other two typing methods, with excellent correlation between all methods. Enzyme electrophoretic typing divided the isolates into the greatest number of distinct groups, resulting in the identification of 10 different L. pneumophila types and 5 types not belonging to L. pneumophila, which probably constitute an undescribed Legionella species. Seven clinical and 34 environmental VAWMC ciolates and 2 non-VAWMC clinical isolates were found to be members of the new species. Twelve different plasmid patterns were VAWMC isolates and 2 non-VAWMC clinical isolates were found to be members of the new species. Twelve different plasmid patterns were found; 95% of VAWMC clinical isolates contained plasmids. Major VAWMC elemic-bacterial types were common in the hospital potable-water distribution system and cooling tower. Strains of L. pneumophila that persisted after disinfection of contaminated environmental sites were of a different type from the prechlorination strains. (Rochester-PTT) W87-00276

DYNAMIC THERMAL STRIPPING PROCE-DURE FOR THE ANALYSIS OF FUEL OIL NO. 2 AND KEROSENE IN WATER,

Army Environmental Hygiene Agency, Aberdeen

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants—Group 5A

Proving Ground, MD.
F. Belkin, and G. G. Esposito.
Journal of Chromatographic Science JCHSBZ,
Vol. 24, No. 5, p 216-219, May 1986. 5 fig, 2 tab, 16

Descriptors: *Pollutant identification, *Thermal stripping, *Fuel oil, *Gas chromatography, *Kerosene, Chemical analysis, Standard deviation.

A dynamic thermal stripping procedure was developed for the determination of low levels of fuel oil no. 2 and kerosene in water. The fuel was purged from water at an elevated temperature with a dynamic thermal stripper and trapped on an adsorption tube, thermally desorbed, and backflushed to a gas chromatograph. Compared to alternate methods, this procedure offers advantages of elimination of solvent usage, small sample size, and low limits of detection. Recoveries of fuel oil no. 2 and kerosene at three different concentration levels from 10- to 1,000-pb fuel in water were evaluated. The recoveries of the fuels varied from 91-114% with the relative standard deviation between 2 and 14%. (Author's abstract) W87-00277

ANNUAL CYCLE OF GASEOUS SULFUR EMISSIONS FROM A NEW ENGLAND SPARTINA ALTERNIFLORA MARSH, Marine Biological Lab., Woods Hole, MA. Ecosystems Center. P.A. Steudler, and B. J. Peterson. Atmospheric Environment ATENBP, Vol. 19, No. 9, p14[1-14]6, September 1985. 3 fig. 1 tab, 20 ref. NSF Grant Nos. DEB 78-03557, DEB 81-04701.

Descriptors: *Biogenic sulfur emissions, *Salt marshes, *Marshes, *Sulfur compounds, *New England salt marsh, Wet lands, Bogs, Swamps, Sulfides.

A flow-through chamber was used to measure the net gaseous sulfur fluxes to the atmosphere from an area of Spartina alterniflora in a New England salt marsh. The fluxes of hydrogen sulfide, dimethyl sulfide, carbonyl sulfide, carbonyl sulfide, carbonyl sulfide, carbonyl disulfide were measured monthly over a year to obtain the annual emission estimates. Peak year to obtain the annual emission estimates. Peak releases of the various sulfur gases did not occur simultaneously but were measured from July through to October depending on the individual sulfur species. The total annual emission was estimated to be 5.8 gram S/sq m/yr, with dimethyl sulfide and hydrogen sulfide the major components emitted. The emissions of the other sulfur gases were nearly 10-fold lower. (Khumbatta-PTT) W87-00281

PERSONAL EXPOSURES, INDOOR-OUT-DOOR RELATIONSHIPS, AND BREATH LEVELS OF TOXIC AIR POLLUTANTS MEAS-URED FOR 355 PERSONS IN NEW JERSEY, Environmental Protection Agency, Research Triangle Park, NC. For primary bibliographic entry see Field 5B. W87-00287

CHEMICAL COMPOSITION OF CLOUD AND RAINWATER. RESULTS OF PRELIMINARY MEASUREMENTS FROM AN AIRCRAFT, Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands). Environmental Dept. F.G. Romer, J. W. Viljeer, L. van den Beld, H. J. Slangewal, and A. A. Veldkamp.
Atmospheric Environment ATENBP, Vol. 19, No. 11, p 1847-1858, November 1985. 13 fig, 4 tab, 16 ref.

Descriptors: *Monitoring, *Rainwater, *Cloud water, *Hydrogen peroxide, *Aircraft, *Air pollution, Precipitation, Pollutants.

Preliminary investigations were carried out into the chemical composition of clouds. The aircraft used was a Piper Navajo Chieftain. Equipment included chemiluminescent monitors for NO, NO2, NOx, and O3, and a pulsed fluorescent SO2 moni-tor. Altitude, speed and temperature were meas-ured continously. The output signals of the instru-

ments were recorded on a data logger. The emphasis was on testing the sampling devices under several conditions and the results clearly showed a spatial distribution in pollutant concentrations caused by contributions of many plume sources and the inhomogeneity of cloudwater density as well. Rather high concentrations of H30(+), Cl(-), NO3(-), SO4(2-), NH4(+) and H2O2 were measured and these components were scavenged very fast during travel over short distances over source regions. H3O(+), NO3(-) and SO4(2-) were likely to be formed by chemical reactions of gaseous precursors with oxidants in the liquid phase. Relatively high molar nitrate/sulphate ratios mainly varying from 1 to 2 were measured over The Netherlands. Occassionally chloride concentration was found to be much higher than could be expected from rain network data. (Khumbatta-PTT) W87-00291

RENEWAL DEVICE FOR TEST SOLUTIONS IN DAPHNIA TOXICITY TESTS,
North Texas State Univ., Denton. Dept. of Biolog-

K. M. Jop, J. H. Rodgers, E. E. Price, and K. L. Dickson.

Bulletin of Environmental Contamination and Toxicology BECTAG, Vol. 36, No. 1, p 95-100, January 1986. 1 fig. 1 tab, 5 ref.

Descriptors: *Bioindicators, *Water analysis, *Renewal devices, *Toxicity tests, *Daphnia, Contamination, Test material degradation, Degradation rate, Pollution.

rate, Pollution.

Acute toxicity tests provide information about lethality of toxic agents or mixed wastes when test organisms are exposed. The tests generally follow three types of laboratory designs depending upon the objective of the test. Static tests are sufficient to assess the acute toxicity of effluents and pure compounds while renewal or continous flow test are recommended for volatile material. The static renewal test is based on transferring live organisms to a chamber containing the same concentration or dilution of test material as that from which organisms were removed. Live and dead animals are then counted in each chamber. However renewing the solutions is time consuming and the possibility of miscounting animals exists. A device was developed that could reduce the time of the whole renewal to 10 minutes without removing the organisms from the test chamber. The system consisted of 2 flasks and a renewal device connected by means of surgical tubing. The results indicated that even a sensitive species like Daphnia pulex was used . The average mortality during testing was similar whether the test solutions were renewed or not however time needed to renew test solutions was significantly reduced. (Khumbatta-PTT)

INJURED COLIFORMS IN DRINKING

WATER, Montana State Univ., Bozeman. Dept. of Microbiology. For primary bibliographic entry see Field 5F. W87-00301

MEASUREMENT OF NITROUS OXIDE REDUCTASE ACTIVITY IN AQUATIC SEDI-Geological Survey, Menlo Park, CA. Water Re-

sources Div.
L. G. Miller, R. S. Oremland, and S. Paulsen.
Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 1, p 18-24, January 1986. 5
fig, 2 tab, 38 ref.

Descriptors: *Water analysis, *Nitrous oxide reductase, *Sediments, *Path of pollutants, Sediment slurries, Kinetics, Nitrogen cycling, Denitrification, Sediment cores, Gas chromatography.

A clear understanding of nitrogen cycling in eco-systems requires a thorough assessment of the pathways and rates of transformation of nitroge-nous compounds. Denitrification in aquatic sedi-ments was measured by an N2O reductase assay.

Sediments consumed small added quantities of N2O over short periods (a few hours). In experiments with sediment alturries, N2O reductase activity was inhibited by 02, C2H2, hest, and high levels of nitrate (1 mM) or sulfide (10 mM). However, ambient levels of nitrate (less than 100 micromole) did not influence activity, and moderate levels (ca. 150 micromole) induced only a short lag before reductase activity began. Moderate levels of sulfide (less than 1 mM) had no effect on N2O reductase activity. Nitrous oxide reductase displayed Michaelis-Menten kinetics in sediments from freshwater, estuarine, and alkaline-saline environments. An in situ assay was devised in which a solution of N2O was injected into scaled glass cores containing intact sediment. Two estimates of net rates of denitrification in San Francisco Bay under approximated in situ conditions were 0.009 and 0.041 mmol of N2O per square m per h. Addition of chlorate to inhibit denitrification in these intact-core experiment resulted in approximately a 14% upward revision of estimates of net rates. These results were comparable to an in situ estimate of 0.022 mmol of N2O per square m per h made with the acetylene block assay. (Main-PTT) W87-00302 W87-00302

METHODS FOR MEASURING SPECIFIC RATES OF MERCURY METHYLATION AND DEGRADATION AND THEIR USE IN DETER MINING FACTORS CONTROLLING NET RATES OF MERCURY METHYLATION, Agassiz North Associates, Winnipeg (Manitoba) P. S. Ramlal, J. W. M. Rudd, and R. E. Hecky.

Applied and Envrionmental Microbiology AEMIDF, Vol. 51, No. 1, p 110-114, January 1986. 3 fig, 2 tab, 25 ref.

Descriptors: "Mercury methylation, "Mercury degradation, "Path of pollutants, Southern Indian, Lake system, Mercury contamination, Fish, Liquid scintillation counters, Sediment.

A method was developed to estimate specific rate of demethylation of methyl mercury in aquatic samples by measuring the volatile (14)CH3HgI demethylation. This method was used in conjunction with a (203)Hg(2+) radiochemical method that determines specific rates of mercury methylation. Through these methods were examined the factors controlling the net rate of mercury methylation. The methodologies were field tested with lake sediment samples from a flooded reservoir in the Southern Indian Lake system in which the fish were contaminated with mercury. Ratios of the specific rates of methylation/demethylation were calculated. The highest ratios of methylation/demethylation occurred in the flooded shorelines of Southern Indian Lake. The results provide an explanation for the increased methyl mercury conplanation for the increased methyl mercury con-centrations in fish after flooding. (Main-PTT) W87-00303

ACTIVITY MEASUREMENTS OF PLANK-TONIC MICROBIAL AND MICROFOULING COMMUNITIES IN A EUTROPHIC ESTUARY, University of South Florida, St. Petersburg. Dept. of Marine Science.

W. H. Jeffrey, and J. H. Paul. Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 1, p 157-162, January 1986. 4 fig, 1 tab, 36 ref.

Descriptors: *Estuaries, *Microfouling, *Eutro-phic estuaries, Bacterial counts, Biofilm, DNA, ATP, Bayboro Harbor, Florida.

(3H)thymidine incorporation, the rate of reduction of iodonitrotetrazolium violet (INT) to INT formazan normilized to DNA, and the ratio of ATP to DNA were adapted to measure the activity of attached and unattached microbial assemblages of Bayboro Harbor, Florida. Activity measurements by (3H)thymidine incorporation were made of cells attached to polystyrene culture dishes, in unfiltered water samples, and in the <1-micron-filtered fraction. The activity of attached cells was greater than that of unattached cells either in unfiltered water samples or in the <1-micron fraction. The calculated thymidine incorporation rates for

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cells in the >1 micron fraction were higher than those for cells either in unfiltered water or in the less than 1-micron-filtered fraction. By the rate of reduction of INT to INT formazan normalized to DNA and by ATP-40-DNA ratios, attached cells were also more active than cells in unfiltered water samples. The microenvironment provided attached microorganisms by the developing biofilm affords a more favorable existence than suspension in the bulk liquid phase. The metabolic by-products of attached organsims may provide an abundant nutrient supply for attached cells. Also, the microenvironment may provide a more stable environment due to the adsorption of molecules and reduced flow within the boundary layer. (Main-PTT) W87-00304

ISOLATION OF NON-01 VIBRIO CHOLERAE SEROVARS FROM OREGON COASTAL ENVI-RONMENTS.

Oregon State Univ., Corvallis. Dept. of Microbi-

ology.
For primary bibliographic entry see Field 5B.
W87-00306

NITRIFICATION RATES IN THE BALTIC SEA: COMPARISON OF THREE ISOTOPE TECH-

Goeteborg Univ. (Sweden). Dept. of Marine Microbiology. V. Enokason.

v. Enormon.

Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 2, p 244-250, February
1986. 4 fig. 1 tab, 24 ref. Swedish Natural Science
Research Council Grants B-UR 2294-110, B-BU
4705-101.

Descriptors: *Path of pollutants, *Water analysis, *Nitrification, *Isotopic tracers, Tracers, Haloclines, Baltic Sea, Seawater.

ultaneous measurements of nitrification in the Simultaneous measurements of nitrification in the Baltic Sea were made at 10- to 30-m intervals in the months of June and November by three isotope techniques: (15N)nitrate dilution, N-serve sensitive (14C)bicarbonate incorporation and (15N)ammonium oxidation to nitrite and nitrate. Nitrification rates of 1 to 280 naomol/liter/day were recorded, and each method showed that the higher rates of nitrification occurred below the halocline. Even in the presence of ammonium, dark incubations of mixed layer (above ca. 50 m) waters never vielded nitrification rates exceeding rates exceeding the control of t dark incubations of mixed layer (above ca. 30 m) waters never yielded nitrification rates exceeding 45 nanomol/liter/day. The rates measured by the ammonium oxidation method were greater than those obtained by (14C) incorporation or (15C) dilution. It is suggested that the (15N) ammonium oxidation method should be used in conjunction with the (14C) bicarbonate incorporation method. (Author's abstract) (Author's abstract) W87-00356

METHODS FOR ISOLATING CAMPYLO-BACTER JEJUNI FROM LOW-TURBIDITY WATER

Veterans Administration Medical Center, Denver, CO. Infectious Diseases Section. M. J. Blaser, and H. J. Cody.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 312-315, February 1986. 4 tab, 21 ref. EPA Cooperative aggreement

Descriptors: *Water analysis, *Monitoring, *Membrane filters, *Filtration, *Human diseases, Filters, Microorganisms, Turbidity, Incubation, Quantitative analysis.

Membrane filtration methods were developed and evaluated for the quantitative recovery of Campylobacter jejuni from environmental waters of low turbidity. The best procedure studied involved passaging the test water through a filter (pore size 0.45 micron) and plating it facedown on Campylobacter-selective agar. After overnight incubation the filter was removed, and the plate was streaked for isolation and then reincubated. This method, with or without prefiltration through 3.0- and 0.6 micron-pore-size membranes consistently resulted micron-pore-size membranes consistently resulted in the recovery of 30 C. jejuni CFU/250 ml of

seeded natural waters. The other methods, plating the final filter face-up or preincubation of the filter in an enrichment medium, were not as sensitive, The technique could be useful in the routine moni-toring of finished waters for C. jejuni or during investigations of suspected waterborne outbreaks for water of low turbidity. (Author's abstract) W87.00359

ISOLATION OF PROTOZOA FROM WATER ASSOCIATED WITH A LEGIONELLOSIS OUTBREAK AND DEMONSTRATION OF INTRACELLULAR MULTIPLICATION OF LEGIONELLA PNEUMOPHILA, Center for Infectious Diseases, Atlanta, GA. J. M. Barbarce, B. S. Fields, J. C. Feeley, G. W. Gorman, and W. T. Martin. Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 422-424, February 1986. 2 fg. 1 tab, 11 ref.

Descriptors: *Protozoa, *Human diseases, Micro-organisma, *Legionellosis, Intracellular multiplica-tion, Bacteria, Cooling towers.

At the site of a legionellosis outbreak, amoebae and two ciliates, Tetrahymena sp. and Cyclidium sp., were isolated from cooling-tower water containing Legionella pneumophila. The Tetrahymena sp. and the amoebae repeatedly showed the ability to support intracellular multiplication of L. pneumophila. Both were isolated from cooling towers specifically implicated as the source for the spread of legionellosis. These protozoa may be reservoirs supporting the survival and multiplication of virulent legionellae in cooling-tower water. (Author's abstract) stract) W87-00362

SENSITIVITY OF MOORE SEWER SWABS FOR ISOLATING SALMONELLA TYPHI, FUR ISULATING SALMONELLA TYPHI, Maryland Univ. at Baltimore. School of Medicine. S. D. Sears, C. Ferreccio, and M. M. Levine. Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 425-426, February 1986. 1 tab, 10 ref. U.S. Army Medical Research and Development Command Grant C-1115.

Descriptors: *Sampling, *Human diseases, *Bacteria, *Sewers, *Salmonella, Toxicity, Isolation, Wastewater.

Moore swabs (sewer swabs) have been used successfully to culture pathogenic organisms from wastewater. Sensitivity seems to depend on the size of the waterway sampled as well as the number of organisms present. In Santiago, Chile, 24 swabs were placed into the sewers draining the homes of 10 known chronic carriers of typhoid. Swabs were positive for Salmonella typhi in 5 of the 10 households (50%) and 6 of the 24 swabs placed (25%). (Author's abstract)

EVALUATION OF WET CHEMICAL METH-ODS FOR QUANTIFYING SULFUR FRACTIONS IN FRESHWATER WETLAND PEAT, R. K. Wieder, G. E. Lang, and V. A. Granus. Limnology and Oceanography LIOCAH, Vol. 30, No. 5, p 1109-1115, September 1985. 3 tab, 31 ref.

Descriptors: *Wetlands, *Bogs, *Sulfur, *Chemical analysis, Ecosystems, Peat, Big Run Bog, West Virginia.

The specificity and efficiency of procedures for fractionating total S into inorganic and organic constituents were evaluated by analyzing a series of known standards. Acid volstilization was specific for FeS. Chromium reduction recovered over 90% of the S from FeS, S(0), and FeS2. Acetone extraction followed by chromium reduction of the some of the S from Fes, SQU, and Fes2. According to the S from Fes, SQU, and Fes2. According to the filtrate was specific for SO. Hydriodic acid reduction recovered > 90% of the S from Fes, SQU(2-), and p-nitrophenyl sulfate, an organic aryl ester sulfate analog. The Zn-HCI reduction procedure is of questionable value, only partially recovering S of questionable value, only partially recovering S from SO4(2-), S(0), and FeS2. None of these procedures affected L-methionine. Analyses were performed on both moist and overdried peat from Big

Run Bog, West Virginia. Oven-drying of peat samples increased estimates of ester sulfate S and SO4(2-)-S and decreased estimates of carbon-bonded S, which was calculated by difference. (Author's abstract) W87-00374

RADIOLOGICAL SAMPLING AND ANALYTICAL METHODS FOR NATIONAL PRIMARY DRINKING WATER REGULATIONS, Eastern Environmental Radiation Facility, Mont-

gomery, AL.

R. L. Blanchard, R. M. A. Hahne, B. Kahn, D.

McCurdy, and R. A. Mellor.

Health Physics, Vol. 48, No. 5, p 587-600, May 1985. 2 tab, 60 ref.

Descriptors: *Drinking water, *Regulations, *Sampling, *Radiochemical analysis, Radium radioisotopes, Uranium radioisotopes, Maximum contamiant level, Radionuclides, Iodine radioisotopes, Strontium radioisotopes, Concentration, Equilibrium, Particle activity, Pollutants, Aquifer characteristics, Alpha-particles, Groundwater pollution.

Radiological sampling and analysis methods performed under the National Interim Primary Drinking Water Regulations for the U.S. Environmental Protection Agency Office of Drinking Water were evaluated. The review was based on the following criteria: analytical screening scheme, sample collection, storage and analysis procedures, selection of analytical methods, reliability of results, and possible future needs. The main flaw in the program has been the dependence on a screening scheme of gross alpha-particle activity measurement and 226-Ra analysis for predicting elevated 228-Ra levels to determine compliance with the maximum contaminant level (MCL) for Ra. In some aquifers, 228-Ra levels were found to be unrelated to 226-Ra levels. Several alternatives were discussed on how to eliminate this problem. Secondly, the measurement for assuring compliance with the MCL for gross alpha-particle activity minus Ra, Rn and U uses chemical U analysis and assumes equilibrium of 238-U and 234-U. Because some ground waters are known to be at disequilibrium, radiometric U analysis was needed for those gross alpha-particle activities and chemical U values that could result in an erroneous conclusion relative to the MCL. Studies were recommended for determining analytical uncertainties, assuring reliable sampling and sample mainteconclusion relative to the MCL. Studies were recommended for determining analytical uncertainties, assuring reliable sampling and sample maintenance. Improvements in the system for accepting methods were suggested. Methods were identified for several radionuclides, not currently in the analytical program, that may be needed to assure absence of elevated radiation doses and could be used for identifying contaminants. (Author's abstract) stract)

OIL SHALE RETORT WATER AMMONIA DE-TERMINATION BY TITRIMETRY, PHENATE COLORIMETRY, ENZYMATIC ANALYSIS, AND CHROMATOGRAPHIC FRACTIONA-TION/CHEMILUMINESCENCE,

California Univ., Richmond. Sanitary Engineering and Environmental Health Research Lab. C. G. Daughton, R. H. Sakaji, and G. W. Langlois. Analytical Chemistry ANCHAM, Vol. 58, No. 7, p. 1556-1561, June 1986. 1 fig. 4 tab, 20 ref. DOE Contract No. DE-AC03-7658*00098.

Descriptors: *Oilshale, *Industrial wastewaters, *Ammonia, *Colorimetry, *Chromatography, *Enzymes, *Wastewater analysis, Chemical analysis

Dissolved ammonia gas and ammonium ion coexist in wastewaters from oil shale retorting, could be inhibitory to biological treatment, and their emission to the atmosphere would pose worker safety/aesthetic problems. A statistical comparison was made of three modified standard methods and a new rapid estimator for determining ammoniac-N in oil shale retort waters: (1) distillation/acidimetric titration, (2) phenate colorimetry, (3) glutamate dehydrogenase enzymatic analysis, and (4) a new, reverse-phase fractionation-combustion/che-

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miluminescence. The latter RPF-C/Cl method used a reverse-phase chromatographic technique to separate polar from nospolar nitrogenous compounds; combustion/chemiluminescence was then used to determine total-N in the polar fraction as a rapid estimate of ammonias-N. For 12 retort waters (1-33 g/liter ammoniac-N), colorometric yielded the lowest, and RPF-C/Cl the highest, concentrations. Paired comparisons showed each pair (save one) of methods gave significantly different results for a majority of waters. However, none gave significantly different results for a composite sample of the 12 waters. The RPF-C/Cl method gave the most rapid estimate of ammonia and would be useful for spot monitoring or range finding for the other methods. (McFarlane-PTT) W87-00431

MEASUREMENT AND CONTROL OF WATER CONTENT OF ORGANIC SOLVENTS, Katholieke Univ. Leuven (Belgium). Lab. of Food Rationeae Univ. Leuven (begjaum). Lab. of Food Technology. H. L. Goderis, B. L. Fouwe, S. M. Van Cauwenbergh, and P. P. Tobback. Analytical Chemistry ANCHAM, Vol. 58, No. 7, p 1561-1563, June 1986. 1 fig, 2 tab, 13 ref.

Descriptors: *Solvents, *Organic compounds, *Water analysis, Tritium, Sample preparation, Humidity, Solubility, Hydrocarbons, Temperature.

An isotopic dilution procedure is described for the quantitative determination of the solubility of water in organic solvents as a function of the relative humidity at which the sample is equilibrated. Tritium is used as a tracer, and the relative humidity conditions are realized by incubation of the organic solvent above a saturated salt solution having a known water activity. The technique is applicable independent of the concentration range of water present, the minimum amount of moisture being only limited by the concentration of the tritium label used. Solubility isotherms of water in hydrocarbon solvents are sigmoidal in shape, reflecting cooperative effects in the solubilization of water molecules at the higher relative humidity portion of the curve. Solubility increases with increasing temperature. (Author's abstract)

MAGNITUDE OF ARTIFACTS CAUSED BY BUBBLES AND HEADSPACE IN THE DETERMINATION OF VOLATILE COMPOUNDS IN

WATER, Oregon Graduate Center, Beaverton. Dept. of Chemical, Biological, and Environmental Sciences.

Analytical Chemistry ANCHAM, Vol. 58, No. 8, p 1822-1826, July 1986. 3 fig, 3 tab, 16 ref. USGS Grant 14-08-0001-A-0038.

Descriptors: *Chemical analysis, *Water analysis, *Volatile compounds, *Headspace, *Error analysis, Organic compounds, Mathematical studies.

The formation of bubbles in a water sample or the presence of headspace above a water sample will cause losses of volatile analytes. Bubbles may occur when groundwaters high in dissolved gases are brought to the surface. Equations are derived to predict the magnitudes of both types of artifacts. Bubbles and headspace can in some cases cause problematic artifacts. In many cases, however, the artifacts they cause will be small for many of the commonly determined organic compounds. In general, if it is known that very volatile compounds are present, the amount of care required in sample storage may be predicted. (McFarlane-PTT) W87-00433

DETERMINATION OF SELECTED AZAAR-ENES IN WATER BY BONDED-PHASE EX-TRACTION AND LIQUID CHROMATOGRA-PHY,

PHY, Geological Survey, Arvada, CO. T. R. Steinheimer, and M. G. Ondrus. Analytical Chemistry ANCHAM, Vol. 58, No. 8, p 1839-1844, July 1986. 2 fig, 9 tab, 33 ref. NSF Grant DFR-8414539.

Descriptors: *Water analysis, *Chemical analysis, *Azaarenes, *Chromatography, *Extraction, Organic compounds, Water analysis, Nitrogen, Hydrocarbons, Aromatic compounds, Quninoline,

Azaarenes are nitrogen analogues of polycyclic aromatic hydrocarbons (PAHs). They are usually found in water in association with sediment, and are believed to be formed during combustion or pyrolysis processes involving fossil fuels. A method for the rapid and simple quantitative determination of quinoline, isoquinoline, and five selected three-ring azaarenes in water has been developed. The azaarene fraction is separated from its carbon analogues on n-octadecyl packing material by elution with acidified water/acetonitrile. Concentration as great as 1000-fold is achieved readily. Instrumental analysis involves high-speed liquid chromatography on flexible-walled, wide-bore columns with fluorescence and ultraviolet detection at several wavelengths employing filter photometers in series. Method-validation data is provided as azaarene recovery efficiency from fortified samples. Distilled water, river water, contaminated ground water, and secondary-treatment effluent have been tested. Recoveries at part-per-billion levels are nearly quantitative for the three-ring compounds, but they decrease for quinoline and isoquinoline. (McFarlane-PTT) W87-00434

DETERMINATION OF PICOGRAM QUANTITIES OF METHYLTINS IN SEDIMENT, Maryland Univ., Solomons. Center for Environmental and Estuarine Studies. C. C. Gilmour, J. H. Tuttle, and J. C. Means. Analytical Chemistry ANCHAM, Vol. 58, No. 8, p 1848-1852, July 1986. 5 fig, 2 tab, 13 ref. NSF Grant No. OCE 8208032.

Descriptors: *Tin, *Trace metals, *Sediments, *Chemical analysis, Heavy metals, Estuaries, Methylation, Gas chromatography, Mass spec-

Methyltin species are ubiquitous in natural waters although their concentration is usually low in waters relatively unimpacted by anthropogenic activity. Sediment slurries are capable of methylating inorganic tin, and concentrations of methylatin species increase with estuarine surface-to-volume ratios. Thus tin methylation in aquatic environments is likely to occur in sediments. Tin methylation probably occurs in anaerobic sediments, degradation of organotins occurs in oxygenated environments, and biomethylation occurs preferentially in anerobic estuarine sediments. An extremely sensitive purge and trap method is described for the determination of methyltins in complex matrices. Organotins were determined directly from sediments and culture medium as the volatile methylstannance. Hydride derivatives were prepared with NaBH4 in a closed, flow-through system consisting of a purge vessel, gas chromatograph, and mass spectrometer. Borate buffer added to samples generated H2 from NaBH4, resulting in high purge efficiencies for mono-, di-, and trimethyltin. Selected ion mode monitoring with the mass spectrometer gave detection limits for methyltins of 3-5 picogram as Sn. Sensitivity achieved was 2 orders of magnitude lower than previously reported for methyltins in sediment. The method is both selective and specific, eliminating most interference while permitting positive identification of individual methyltin species. (McFarlane-PTT)

SCREENING OF ANTHROPOGENIC COM-POUNDS IN POLLUTED SEDIMENTS AND SOILS BY FLASH EVAPORATION/PYROLY-SIS GAS CHROMATOGRAPHY-MASS SPEC-

SIS GAS CHROMATOGRAPHY-MASS SPECTROMETRY,
Technische Hogeschool Delft (Netherlands). Dept. of Chemical Engineering and Chemistry.
J. W. de Leeuw, E. W. B. de Leer, J. S. S. Damste, and P. J. W. Schuyl.
Analytical Chemistry ANCHAM, Vol. 58, No. 8, p 1852-1857, July 1986. 3 fig, 3 tab, 20 ref.

Descriptors: *Soil contamination, *Sediment contamination, *Flash evaporation, *Mass spectrome-

try, *Gas chromatography, *Chemical analysis, Soil environment, Hydrocarbons, Aromatic com-pounds, Sulphur, Cyanide.

pounds, Sulphur, Cyanide.

The use of flash evaporation and pyrolysis gas chromatography-mass spectrometry as a fast screening procedure for anthropogenic substances in environmental samples is demonstrated by the analysis of polluted soil and sediment samples. Polycyclic aromatic hydrocarbons, haloorganics, aliphatic hydrocarbons, heteroaromatics, elemental sulfur, cyanides, and pyrolysis products of synthetic polymers are among the anthropogenic substances that can be readily detected by this method in one analysis. Elimination of wet chemical sample preparation enables a complete analysis to be performed and data to be quickly analyzed. The detection limits are in the low part-per-million range using mass spectrometric detection. Alternatively, detection of compounds can be achieved by all common gas chromatography detections (flame ionization detector, electron capture detectors (flame ionization detector, electron capture detector) and flame photometric detector), and detection limits are determined by the method of detection employed. It is a valuable tool for rapidly screening polluted samples for virtually all types of anthropogenic contaminants except for heavy metals. (Author's abstract) (Author's abstract) W87-00436

PRINCIPAL COMPONENT ANALYSIS OF TRACE SUBSTANCE CONCENTRATIONS IN RAINWATER SAMPLES,

Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer drologie. W. Thomas.

Atmospheric Environment ATENBP, Vol. 20, No. 5, p 995-1000, 1986. 1 fig. 4 tab, 15 ref.

Descriptors: *Chemistry of precipitation, *Trace elements, *Rain, *Water pollution sources, *Water sampling, *Chlorinated hydrocarbons, Zinc, Cadmium, Lead, Curium, Multivariate analysis, Seasonal variation, Suburban areas, Rural areas, Polyaromatic hydrocarbons, Germany, Pesticides, Heavy metals, Chemical analysis, Spatial distribution

Bulk precipitation samples (197) from rural and suburban stations in Bavaria, West Germany were analyzed for polyaromatic hydrocarbons (PAH), chlorinated hydrocarbons and trace metals. Data was analyszed using multivariate component analy-sis for suburban and rural sites and for summer and sis for suburban and rural sites and for summer and winter events. Resulting component loadings matrices were characterized by typical patterns indicating differences of the emission of the single pollutants in terms of location and seasonality. PAH and Pb may be used for the interpretation of the data structure of suburban sites. Pb concentrations are elevated in the rainwater samples of these stations during all seasons. PAH concentrations indicate space-heating effects by showing elevated levels during the winter. At rural sites, benzohexachloride pesticides are highly enriched in rainwater samples in the spring and summer. (Author's abstract) abstract) W87-00461

DETERMINATION OF DEUTERIUM IN WATER BY GAS-PHASE INFRARED SPECTROPHOTOMETRY, Florida State Univ., Tallahassee. Dept. of Chemis-

For primary bibliographic entry see Field 2K. W87-00434

ANALYTICAL QUALITY CONTROL IN UNITED KINGDOM WATER INDUSTRY, WITH PARTICULAR REFERENCE TO HARMONIZED MONITORING SCHEME FOR RIVER WATER QUALITY,

Anglian Water Authority, Huntingdon (England). For primary bibliographic entry see Field 7A. W87-00491

ISOLATING VIRUSES FROM FINISHED

Group 5A-Identification Of Pollutants

Arizona Univ., Tucson. Coll. of Agriculture.
J. B. Rose, C. P. Gerba, S. N. Singh, G. A.
Toranzos, and B. Keswick.
American Water Works Association Journal
JAWWAS, Vol. 78, No. 1, p 56-61, January 1986,
1 fig. 4 tab, 30 ref. EPA Grant CR 809331010.

Descriptors: *Viruses, *Water treatment, *Floccu-lation, *Chlorination, *Filtration, Clarification, Coliforms, Chlorine, Residual chlorine, Separation techniques, Enteroviruses, Drinking water, Tur-

Beduction of enteroviruses and rotaviruses averaged 81 and 93% respectively, at a full-scale 205-mdg (776 ML/d) plant whose treatment train includes chemical floculation, sand filtration, and chlorination. The highest reduction of enteroviruses occurred during prechlorination-floculation and filtration, whereas the highest reduction of rotaviruses occurred during prechlorination-floculation, and final chlorination. Enteroviruses or rotaviruses occurred in 24% of the finished water samples, which had >0.2 mg free chlorine/L and met coliform bacteria (1/100 mL) and turbidity (1 mt) standards. Although major plant deficiencies may have been responsible for the occurrence of viruses in the finished water with measurable levels of free residual chlorine and meeting standards for coliform bacteria and turbidity, cannot be assumed to be virus free. (Author's abstract)

TUBE AND CARTRIDGE METHOD FOR DOWN-HOLE SAMPLING FOR TRACE ORGANIC COMPOUNDS IN GROUND WATER, Oregon Graduate Center, Beaverton.

J. F. Pankow, L. M. Isabelle, J. P. Hewetson, and

J. A. Cherry. Groundwater GRWAAP, Vol. 23, No. 6, p 775-782, November-December 1985. 2 fig, 2 tab, 19 ref.

Descriptors: *Sampling, *Groundwater pollution, *Pollutant identification, *Organic compounds, *Piezometers, Gas chromatography, Water analysis, Wells, Trace levels, Sorption.

A small groundwater sampling device has been developed which extends the down-hole use of the adsorption/thermal desorption (ATD) analysis method for someone compounds to were method for nonpolar organic compounds to very narrow piezometers (I.D. > 0.64 cm). The sampler narrow piezometers (I.D. > 0.64 cm). The sampler consists of a sorbent cartridge, a flow restrictor, and a tube leading to the ground surface. The device is lowered down a piezometer, and water-column pressure forces the sample through the cartridge. In the laboratory, the water is removed from the cartridge and the sorbed compounds are thermally desorbed to a gas chromatography column for analysis. Since the analytes are sorbed as the cartidge down the cart column for analysis. Since the analytes are sorbed on the cartridge down-hole, volatilization losses are avoided. Samples can be obtained without being influenced by the water column above the sampler or by tubing or pumps; many uncertainties associated with well purging and contamination from well casings and samplers can be minimized. The method was tested by sampling at a landfill. The coefficients of variation were in the 10-18% causes at the low microgress (little least The limits and the control of the land the limits and the low microgress (little least The limits and the land limits and the limits and the land limits and land limi The coefficients of variation were in the 10-18% range at the low microgram/liter level. The limits of detection for several compounds were all under 0.1 microgram/liter, some being less than 1 nanogram/liter. Sorption efficiencies of >93% were found for a variety of compounds. The method will be attractive when sensitivity and freedom from volatilization losses and sampler-related contamination are required. (Author's abstract) WE7-00514

METHOD FOR DETERMINING ENZYMATI-CALLY HYDROLYZABLE PHOSPHATE (EHP) IN NATURAL WATERS, Warsaw Univ. (Poland). Dept. of Environmental Microbiology. R. J. Chrost, W. Siuda, D. Albrecht, and J. Cuerbeck.

Overbeck. Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 662-667, May 1986. 3 fig. 1 tab, 21 ref. MSEHE Project MR.II.17, Poland.

Descriptors: *Phosphates, *Enzymatically-hydrolyzable phosphate, *Chemical analysis, *Freshwa-

ter, "Seawater, "Eutrophic lakes, Strickland and Parsons method, Europe, North Sea, Baltic Sea, Hypereutrophic lakes, Organophosphoric esters, Phosphohydrolases, Enzymes, Aquatic life.

Phosphonydrolases, Enzymes, Aquatic life.

The described method for determining enzymatically hydrolyzable phosphate (EHP) is based on the determination of released inorganic phosphate after the hydrolysis of organophosphoric esters by free, dissolved phosphotydrolases (mainly phosphatase) produced by the biota. The method gives higher values in highly eutrophic waters than the classical procedure of Strickland and Paraons; in samples from less eutrophic lakes the two methods give similar results. The new method is simple, accurate, and can be used in both freshwater and marine studies. It is particularly recommended for determination in hypereutrophic waters, when incrpanic P concentrations exceed 25 microgram/liter. Representative data from the euphotic zone of seven European lakes, the North Sea, and the Baltic Sea are given. (Rochester-PTT)

IMPORTANCE OF DISSOLVED ORGANIC MATTER IN THE NUTRITION OF ZOO-PLANKTON IN SOME LAKE WATERS, Helsinki Univ., Lammi (Finland). Lammi Biological Station. For primary bibliographic entry see Field 2H. W87-00576

SPECTROPHOTOMETRIC DETERMINATION OF DISSOLVED ORGANIC CARBON IN PEAT

WATERS, McGill Univ., Montreal (Quebec). Dept. of Geography. T. R. Moore

Soil Science Society of America Journal SSSJD4, Vol. 49, No. 6, p 1590-1592, November-December 1985. 2 fig, 1 tab, 11 ref.

Descriptors: *Dissolved solids, *Organic carbon, *Quebec, *Peat soils, Fens, Bogs, Schefferville, Sept-Iles, Canada, Iron.

An absorbance/dissolved organic carbon (DOC) relationship, applicable to a range of peat waters of differing geochemistry and organic matter type was established. Based on spectra of peat water samples representing a range of geochemical origin from minerotrophic feas to ombrotrophic bogs, DOC was only weakly predicted by absorbance at 330 nm. Differences in molecular weight fractions in the disolved organic matter apparently did not 330 nm. Differences in molecular weight fractions in the dissolved organic matter apparently did not affect the correlation. Forty samples were collected from peatlands in the Schefferville and Sept-Iles areas of northern Quebec, representing fens and bogs, respectively. Major improvement in the predictive power of absorbance at 330 nm was produced by inclusion of the Fe content of the peat water, which can be determined simply as o-phenanthroline reactive Fe. Dichromate-oxidizable organic C was also predicted well from absorbance at 330 nm. (Peters-PTT)

WATER ANALYSIS BY ZEEMAN ATOMIC AB-SORPTION SPECTROMETRY, Paris-6 Univ. (France). Lab. de Geochimie et Me-

A. M. DeKerssbiec, G. Blanc, and M. Pinta. Fresenius' Zeitschrift für Analytische Chemie ZACFAU, Vol. 322, No. 7, p 731-735, December 1985. 3 fig, 7 tab, 11 ref.

Descriptors: *Atomic absorption spectrometry, *Chemical analysis, *Trace elements, Zeeman effect, Carbonates, Sulfates, Chlorides, Brines,

The determination of trace element concentrations in fresh and marine waters presents many difficulties because the quantities generally found are below ppb. It is possible to achieve such low detection limits by extraction followed by atomic properties are acceptance with leavest the second of the contraction of th absorption spectrometry with electrothermal atom-ization, provided errors due to nonspecific absorp-tion are eliminated as completely as possible. The employment of the Zeeman effect gave a mean for

effective correlation. The techniques are based on the analysis of dry residues for fresh waters and on extraction by organic solvents or ion-exchange resin for fresh and marine waters. The dry residue resin for fresh and marine waters. The dry residue from fresh water generally consists of carbonates, sulfates, and chlorides. Marine waters of normal salinity (about 3.5%) have very low contents of trace elements and can be analyzed after precon-centration with a solvent or a resin. The analysis of hydrothermal brines where the salt content can reach 25% and which are relatively rich in trace elements can be made directly by employing the Zeeman correction and the addition of a modifier such as NH4NO3. (Peters-PTT)

DETERMINATION OF SUB-NG/ML LEVELS OF MERCURY IN WATER BY ELECTROLITIC IC DEPOSITION AND ELECTROTHERMAL ATOMIC-ABSORPTION SPECTROMETRY, East China Normal Univ., Shanghai. Dept. of

Chemistry. B. -X. Xu, T. -M. Xu, M. -N. Shen, and Y. -Z.

Fang.
Talanta TLNTAZ, Vol. 32, No. 10, p 1016-1018,
October 1985. 4 fig, 1 tab, 8 ref.

Descriptors: *Atomic absorption spectrometry, *Chemical analysis, *Mercury, *Trace metals, Iron, Cadmium, Lead, Copper, Nickel, Metals, Aluminum, Manganese, Chromium.

A simple electrolytic deposition was combined with electrothermal atomic-absorption spectrometry (AAS) for the determination of trace mercury in water. Traces of mercury in water are preconcentrated by electrolytic reduction and deposition on a platinum wire cathode, which is then put into a graphite cup for direct atomization and measurement. The method is sensitive and simple, with a detection limit of 0.04 nanogram/ml. Almost all the metal ions commonly found in water samples can be tolerated, because of the selective deposition at controlled potential. The determination of mercury at the 0.4 nanogram/ml level was not affected by the presence of 200 nanogram/ml levels of Fe, Cd, Mn, Cr, Pb, Cu, Ni, and Al. (Peters-PTT)

NEW ION-SELECTIVE ELECTRODE FOR NITRATE DETERMINATION.

Muenster Univ. (Germany, F.R.). Anorganisch-Chemisches Inst. For primary bibliographic entry see Field 2K. W87-00648

POLLUTION RECONNAISSANCE IN STREAM SEDIMENTS USING NON-RESIDUAL TRACE METALS.

Liverpool Univ. (England). Dept. of Oceanography. R. Chester, W. M. Kudoja, A. Thomas, and J.

Environmental Pollution (Series B) EPSPDH, Vol. 10, No. 3, p 213-238, 1985. 2 fig, 4 tab, 18 ref,

Descriptors: *Pollutant identification, *Trace metals, *Metals, *Stream sediments, *England, Non-residual trace metals, Iron, Manganese, Cobalt, Nickel, Chromium, Copper, Lead, Zinc, Cadmium, Pollutants, Northwest England.

Total non-residual (TNR) concentrations of Fe, Mn, Co, Ni, Cr, Cu, Pb, Zn, and Cd have been determined in sediments from ten stream populations in North West England using a rapid 0.5 HCl leaching technique. The technique can successfully be used as a first stage in a reconnaissance survey designed to identify trace metal pollution in stream sediments. The TNR trace metal concentrations are extremely variable in the sediments and a number of approaches are assessed in order to interpret the data in an environmentally useful manner. (i) Spatial variations in the distributions of manner. (i) Spatial variations in the distributions of the TNR trace metals in individual stream popula-tions can be used to identify specific pollution sources, which often impose man-made finger-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants-Group 5A

prints' on the sediments. (ii) In order to establish baseline concentrations for all the stream sediments, an artificial background sediment (ABS) is identified and sediments which have suffered polution are identified as those whose TNR trace metal concentrations exceed an Ex sub ABS + 2s parameter, in which Ex sub ABS is the concentration of an element, E, in the ABS. The degree of pollution is assessed by an index of pollution (IP), which is related to the Ex sub ABS + 2s parameter. (iii) Partitioning of the trace matals in the non-residual sediments fraction is investigated using a five-stage sequential leaching technique. The application of the technique to a series of polluted and nonpolluted stream sediments shows that the partitioning characteristics of a number of the TNR trace metals differ in respect to their host components. Further, the partitioning signatures of some of the TNR trace metals, especially that of Cd, are different in polluted and nonpolluted samples. (Author's abstract)

EFFECT OF MERCURY ON SOME AQUATIC PLANTS.

Institute of Science, Bombay (India). Dept. of Botany. For primary bibliographic entry see Field 5C. W87-00660

EFFECT OF BIODEGRADATION ON THE DE-TERMINATION OF SOME CHEMODYNAMIC PROPERTIES OF PHTHALATE ESTERS, State Univ. of New York at Binghamton. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W87-00678

SEWAGE EFFLUENT BIOMONITORING: I. SURVIVAL, GROWTH AND HISTOPATHOLOGICAL EFFECTS IN CHANNEL CATFISH, Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
S. V. Mitz, and J. P. Giesy.
Ecotoxicology and Environmental Safety

o. v. Mitz, and J. P. Giesy.
Ecotoxicology and Environmental Safety
EESADV, Vol. 10, No. 1, p 22-39, August 1985, 6
fig, 3 tab, 40 ref. DOE Contract No. DE-AC0976SR00819.

Descriptors: *Sewage effluents, *Bioindicators, *Wastewater outfall, *Histopathological effects, *Channel catfish, *Montrose, *Michigan, *Flint River, Wastewater tratment, Fish, Wastewater facilities, Sewer systems, Residual chlorine.

cilities, Sewer systems, Residual chlorine.

A 17-day, in situ, biomonitoring study using caged, juvenile channel catfish was conducted at five sites along a 9-km section of the Flint River at the Anthony Ragnone Wastewater Treatment Plant near Montrose, Michigan. Effects on survival, growth, and gill and liver histopathology were examined. No differences in growth, measured as wet weight gain, were observed between upstream control (UP) and experimental fish located 9 km downstream from the outfall. Mortality was probably due to excessive mean total residual chlorine concentration. Forty percent of the fish a UP had slight hyperplasia and hypertrophy of the respiratory epithelium. 38% of livers from the UP fish were extremely vacuolated (dense) liver sections stained negatively for lipids with oil red O. There was no correlation between the histopathological changes and any deleterious effects on growth or survival during the 17-day exposure. (See also W87-00682) (Khumbatta-PTT)

SEWAGE EFFLUENT BIOMONITORING: II. BIOCHEMICAL INDICATORS OF AMMONIA

BIOCHEMICAL INDICATORS OF AMMONIA EXPOSURE IN CHANNEL CATFISH, Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

S. V. Mitz, and J. P. Giesy.
Ecotoxicology and Environmental Safety EESADV, Vol. 10, No. 1, p 40-52, August 1985. 1 fig. 4 tab, 43 ref. DOE Contract DE-AC09-76SR00819.

Descriptors: *Water pollution effects, *Sewage effluents, *Biomindicators, *Ammonia, *Wastewater

outfall, *Channel catfish, Fish, Ammonium compounds, Sewer systems, Wastewater facilities.

pounds, Sewer systems, Wastewater facilities.

Ammonia is the predominate form of nitrogenous waste produced by ammonotelic freshwater teleosts. Channel catifish were exposed, in situ, to sewage effluent for 17 days to determine the effect of unionized ammonia (UIA) on concentrations of glutamate, glutamine and alpha-ketoglutarate (alpha-KGA) in brain tissue, and activity of glutamate dehydrogenase (L-GDH) in liver tissue. Laboratory studies of fish exposed to UIA suggested that one would expect to observe increased glutamine concentrations in brain tissue due to amination of glutamate. However, no significant differences were observed in the concentrations of glutamate, glutamine, or alpha-KGA, or specific activity of L-GDH between fish at the two study locations, including exposure to 0.032 mg UIA/liter for 17 days. Therefore, under the observed field conditions these parameters were not useful biochemical indicators of exposure to potentially deterimental concentrations of UIA. (See also W87-00681) (Khumbatta-PTT)

ANION ANALYSIS OF HIGH PURITY WATER,

thern California Edison Co., Paramount.

Southern California Edison Co., Paramount. F. M. Cutler.
The Journal of Environmental Sciences, Vol. 29, No. 1, p 44-50, January-February 1986. 10 fig, 9 tab.

Descriptors: *Chemical analysis, *Ion chromatography, *Conductivity, *Resistivity, *Temperature effects, Pure water, High purity water, Trace impurities, Pollutants.

To provide ultra pure water for industrial applications, chloride, fluoride, sulfate, formate, acetate
and glycolate at the ppb and ppt level were identified by ion chromatographic (IC) techniques.
Sample collection and conditioning methods are
summarized. The relationships between conductivity, acid conductivity and the level of ionic contamination are examined. Specific analytical techniques such as IC need to be used in conjuncion
with other monitoring methods of ultra pure
water. The nonspecific nature of the measurement,
the small response to sub-ppb changes in contaminant concentrations and the need for accurate temperature measurement and compensation require
that more specific analytical techniques also be
used to obtain information on solutions very close
to pure water. (Khumbatta-PTT)
W87-00688

GAS CHROMATOGRAPHIC ANALYSIS OF TRACE METALS ISOLATED FROM AQUEOUS SOLUTIONS AS DIETHYLDITHIOCAR-

OUS SOLUTIONS AS DISTHYLDITHIOCAR-BAMATES, Concordia Univ., Sir George Williams Campus, Montreal (Quebec). Dept. of Chemistry. For primary bibliographic entry see Field 2K. W87-00709

SOLUBILITY OF AMMONIA IN LIQUID WATER AND GENERATION OF TRACE LEVELS OF STANDARD GASEOUS AMMO-

NIA,
P. K. Dasgupta, and S. Dong.
Atmospheric Environment ATENBP, Vol. 20, No. 3, p 565-570, March 1986. 5 fig. 1 tab, 14 ref.
Electric Power Research Inst. Contract RP-1630-

Descriptors: *Ammonia, *Mathematical analysis, *Solubility, *Trace levels, Henry's law, Mathematical equations, Temperatures, Hydrogen ion concentration, Chemical reactions, Pollutant identification, Chemical reactions, Pollutant identification, Chemical reactions, Pollutant identifications, Polluta

Equilibrium gas phase concentrations of ammonia in dilute solution has been measured as a function of total ammonia + ammonium concentration (0.002-0.10 M), pH (6-10) and temperature (278.8-290.6 K). Henry's Law is obeyed under these conditions and may be expressed as an in K sub H (M/atm) = 4092/T - 9.70 with a standard error of <

5%, in good agreement with NBS thermodynamic data. Convenient generation of trace levels of ammonia (1.33 x 10 to the minus 8th power - 0.000777 atm) using a porous membrane tube is described. It is concluded that the aqueous solubility of ammonia can be calculated via mathematical analysis. At ambient temperatures between 0 and 25 C, the value of K sub H is 3.0 - 0.3% higher when using the aforementioned equation, than with other equations for evaluating this solubility. (Lantz-PTT) W8T-00721

IDENTIFICATION OF O, O-DIALKYL-S-METHYLPHOSPHORODITHIOATE RESI-

Food and Drug Administration, Washington, DC. Div. of Chemical Technology.

M. P. Yurawecz, and B. J. Puma. Association of Official Analytical Chemists Jour-nal JANCA, Vol. 69, No. 2, p 214-217, March-April 1986. 4 fig. 1 tab, 10 ref.

Descriptors: *Pesticides, *Fish, *Pollutant identifi-cation, *Methylphosphorodithioate, *Tissue analy-sis, Mississippi River, Buffalo fish, Contamination, Organic matter, Hartford River, Wood River, Illi-nois, Delaware River, Newark Bay, New Jersey, Water pollution effects, Fate of pollutants.

Water pollution effects, Fate of pollutants.

O, O-Dialkyl-S-methylphosphorodithioates were found in Mississippi River buffalo fish caught near several plants and oil refineries in Hartford and Wood River, IL. These chemicals, which have not been previously recognized as environmental or food contaminants, were identified and quantitated by a procedure similar to the Association of Official Analytical Chemists (AOAC) multiresidue method for organochlorine and organophosphorus pesticides, using gas chromatography (GC) with flame photometric detection (FPD). The key to identifing them was a GC/FPD retention time pattern that was virtually the same as that for the diazomethane reaction products of a commercial zinc dialkyl dithiophosphate motor oil additive. GC/mass spectrometry (MS) showed that the compound producing the largest GC/FPD pathylphosphorodithioate (Compound C) was confirmed by GC/MS analysis by comparison with the authentic material. The buffalo fish contained 0.15 ppm Compound C and 0.5 ppm total O, O-dialkyl-S-methylphosphorodithioate (Compound C) was confirmed by GC/mS analysis by comparison with the authentic material. The buffalo fish contained 0.15 ppm Compound C and 0.5 ppm total O, O-dialkyl-S-methylphosphorodithioates. Subsequent analyses of fish from other areas showed that these contaminants were not limited to the Hartford-Wood River area. Lower residue levels of Compound C ranging from 0.01 to 0.03 ppm, were found in fish from the Mississippi River at Sauget, IL, and from the Delaware River and Newark Bay in NJ. (Author's abstract)

NOTE ON THE USE OF RAPPAPORT-VASSI-LIADIS MEDIUM (R10/RV) FOR THE ISOLA-TION OF SALMONELLAS FROM SEWAGE AND SEWAGE SLUDGES, North West Water Authority, Warrington (Eng-land). Western Div. D. C. Watson.

Journal of Applied Bacteriology JABAA4, Vol. 59, No. 2, p 205-206, August 1985. 1 tab, 5 ref.

Descriptors: *Culture media, *Isolation, *Salmonella, *Wastewater, *Sludge, Selective media, Sewage bacteria, Bacteria.

The use of a modified Rappaport broth for the selective enrichment of salmonellas in sewage sludge is described. Comparative trials were carried out using Muller Kauffman-Tetrathionate (MKT) broth and Rappaport Vassiliadis (R10/RV) medium for selective enrichment. R10/RV broth gave on the average a higher count of salmonellas per 100 ml of wet sludge than did MKT for the same sample, and is to be preferred for routine monitoring. However, while 44% of all samples gave higher counts with R10/RV than with MKT as the selective enrichment medium, 39% of all samples gave the same count with both media, thus

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not invalidating previous work using MKT.

BIOMONITORING NETWORKS OPERATED BY SCHOOLCHILDREN, International Joint Commission-United State Canada, Windsor (Ontario). Por primary bibliographic entry see Field 7A. W87-00771 n-United States and

INCIDENCE OF THREE NEW SALMONELLA SEROTYPES - S. IRUMU, S. PANANA & S. LEXINGTON FROM THE SOUTH-EAST COAST OF INDIA (PORTO NOVO), Amamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Biology. T. Ramamurthy, S. Ramesh, and R. Natarajan. Indian Journal of Medical Research LIMRAQ, Vol. 81, No. 6, p 558-560, June 1985. 1 tab, 17 ref.

Descriptors: *Salmonella, *India, *Pathogenic bacteria, *Public health, Pathogens, Bacteria, Sediments, Plankton.

The incidence of three new Salmonella serotypes was recorded for the first time in India in environwas recorded for the first time in India in environ-mental samples for Pitchavaram mangrove and Vellar estuary. They include S. irumu 6,7:1,v:1,5 (group C sub 1); S. panama 1,9,12:1,v:1,5 (group D sub 1); Fifty-four samples representing water, sedi-ment, and plankton from the two biotopes were ment, and plankton from the two blotopes were collected over a six-month period. Twenty-three cultural positive samples for Salmonella were identified and found contaminated with S. irumu (6 strains). S. panama (8 strains), and S. lexington (17 strains). (Author's abstract)

RADIOACTIVITY IN SILT FROM THE RIVER LEA, ENGLAND, North East London Polytechnic (England). Dept. of Physical Science L. R. Day, and H. H. Zumpe. Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 1, p 75-84, 1986. 2 fig, 2 tab, 8 ref.

Descriptors: *Radioactivity, *Silt, *River Lea, *England, Potassium, Uranium, Thorium, Fallout, Water quality, Sediments.

Levels of radioactivity in silt in the River Lea Levels of radioactivity in silt in the River Lea using the gross beta count rate method and gamma-ray spectrometry have been measured. Re-sults show that the environmental levels are very low and appear to be due to naturally occurring potassium, uranium, and thorium, and a small amount of 137-Cs, probably from failout. The evi-dence suggests that pollution due to radioactivity present in the river is negligible. (Author's abstract) W87-00790

REPETITIVE STRIPPING AND TRAPPING APPLIED TO THE DETERMINATION OF TRACE HYDROCARBONS IN AQUEOUS

TRACE HIBBACO SAMPLES, SAMPLES, Ceskoslovenska Akademie Ved, Brno. Ustav Ana-

lyticke Chemi.

J. Drozd, Z. Vodakova, and J. Novak.

Journal of Chromatography JOCRAM, Vol. 354,
p 47-57, February 28, 1986. 4 fig. 3 tab, 15 ref.

Descriptors: *Chemical analysis, *Hydrocarbons, *Trace levels, *Quantitative analysis, *Water analysis, Wastewater analysis, Stripping, Trapping, Benzene, Toluene, Decane, Undecane, Dodecane.

The method of repetitive stripping and trapping of analytes was investigated to determine the reliabil-ity of the quantitative results. Different experimen-tal variants of the method were tested by analyzing sal variants of the method were tested by analyzing water-air model systems with low levels of benzene, toluene, n-decane, n-undecane, and n-dodecane as analytes in the aqueous phase. Whereas in a closed circuit the stripping/trapping process can be conducted either in a conservation or in an equilibration regime, in an open arrangement the

conservation or pseudoequilibration (non-station-ary conditions) mode of trapping is possible. All these variants yielded good quantitative results. Systematic negative errors of 20-40% were attri-uted to non-constant (concentration-dependent) matrix effects associated with the adsorption of the analytes at the water-air interface. The ability of the repetitive stripping/trapping method to elimi-nate such effects was tested by comparing the results for the determination of low micro g/l levels of benzene, toluene, and n-decane is a water-air and in a water-Carbowax 400 (9:1)-air system. Whereas the method of external calibration by means of a reference water-air system gave erronemeans of a reference water-air system gave errone-ous results for the system with Carbowax 400, the ults obtained by the repetitive stripping/trap-ig method were correct. (Author's abstract)

CHARACTERIZATION OF MINERAL WATERS BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY, Rome Univ. (Italy). Dept. of Chemistry. G. P. Cartoni, and F. Coccioli. Journal of Chromatography JOCRAM, Vol. 360, No. 1, p 225-230, June 1986. 2 fig, 3 tab, 8 ref.

Descriptors: *Mineral water, *Chemical analysis, *Chromatography, *Pollutant identification, Gas liquid chromatography, Organic matter, Phenylindole, Water pollution.

Results are reported for some Italian mineral waters by high-performance liquid chromography (HPLC) with an on-line trace enrichment of the non-volatile organic fraction. HPLC studies have been carried out on the analysis of surface waters, especially for pollutant determinations. Priority pollutant phenols have been determined at trace levels. In drinking water, the non-volatile organic compounds were analyzed by HPLC and some compounds identified by mass spectrometry. The on-line trace enrichment by HPLC has been applied to identify some pollutants in lake water and in mineral and river waters. Reversed-phase HPLC has been applied to the determination of dissolved organic matter in estuarine water. High-performance size exclusion chromatography was employed to study aquatic humic substances, and their molecular weight range was estimated. The addition of chlorine to drinking water produces chlorinated compounds from the humic substances, and those have been identified by gas chromatography. Finally, the contamination of water stored in plastic bottles has been investigated by HPLC. This procedure of trace enrichment on the top of the analytical column is advantageous for cliduted samples such as mineral waters. With the Into procedure of trace enrichment on the top of the analytical column is advantageous for clear diluted samples such as mineral waters. With the described method the risk of contamination from solvents and laboratory manipulation is strongly reduced. No instrument modification is required and any commerical apparatus can be used. The chromatograms obtained are very characteristic chromatograms obtained are very characteristic for each type of mineral water examined, and as it is required to determine the chemical composition of inorganic constituents, an HPLC analysis of the dissolved organic materials should also be carried out. The majoor components of these non-volatile organic materials should also be carried out. The organic materials should also be carried out. The major components of these non-volatile organic substances are the humic compounds found at a wide range of concentrations. Phenylindole has been identified in mineral waters stored in plastic containers. (Lantz-PTT) W87-00795

WATER QUALITY INDEX: APPLICATION IN THE WARRI RIVER, NIGERIA, Benin Univ., Benin City (Nigeria). Dept. of Zoolo-

gy.
A. B. M. Egborge, and J. Benka-Coker.
Environmental Pollution (Series B) EPSPDH,
Vol. 12, No. 1, p 27-40, 1986. 11 fig, 15 ref.

Descriptors: "Water quality, "Water quality standards, "Warri River, Pollutant identification, "Nigeria, Physical properties, Seasonal variation, Dissolved oxygen, Oxygen, Biological oxygen demand, Oxygen demand, Turbidity, Solids, Nirtates, Phosphates, Hydrogen ion concentration, Coliforms, Bacteria, Temperature, Water pollution

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The seasonal variations in the water quality indices of dissolved oxygen, biological oxygen demand (BOD), turbidity, total solids, nitrates, phosphates, hydrogen-ion concentration (pH), temperature, and fecal coliforms of the Warri River at five and fecal coliforms of the Warri River at five sampling points were investigated from July 1981. The waters are oligotrophic with respect to nitrate and phosphate levels and therefore excellent throughout the period of investigation. Water quality indices for pH and temperature also showed that the waters were medium to good from month to month. However, water quality indices for dissolved oxygen, turbidity, and total solids revealed a seasonal effect on these parameters, although the waters were generally medium to good. With respect to fecal coliforms, there was a longitudinal gradient whereby the waters deteriorated from Udu Bridge (near the source) to Warri, where they are very polluted as a result of indiscriminate disposal of human wastes into the river. The application of the weighted mean index to all nine parameters showed the Warri River river. The application of the weighted mean index to all nine parameters showed the Warri River waters to be medium to good. The immediate source of pollution in the Warri River is sewage, rather than industrial. (Author's abstract)

IDENTIFICATION OF POLLUTANT OR TRACER SOURCES USING DISPERSION THEORY,

Institute of Hydrology, Wallingford (England).
P. G. Whitehead, R. J. Williams, and G. M.

Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 273-286, May 30, 1986. 5 fig, 3 tab, 13 ref, National Park Service Contract CX-0001-9-0038.

Descriptors: *Dispersion theory, *Water pollution sources, *Tracers, *Pollutant identification, *Bedford Ouse River, *White Oak Run, England, Virginia, Hydraulic geometry, Stream velocity, Currents, Pollutants, Peclet numbers, Dispersion coefficient, Algorithms, Optimization, Flow rates.

A technique based on dispersion theory for the identification of a pollutant or tracer entering a river system employs an optimization algorithm to estimate Peclet numbers and dispersion coefficients from tracer experiments conducted over a range of flow rates prior to application to pollution problems. Data from the Bedford Ouse River (Southeastern England) and White Oak Run (Virginia) are used to demonstrate the approach. The variation with flow rate of stream velocity and dispersion coefficient is investigated. The sensitivity of the technique to errors in the dispersion coefficient is evaluated. It is concluded that experimentally derived dispersion coefficients are preferable to values obtained using hydraulic or channel geometric approaches. (Author's abstract)

ANALYSIS, ACCUMULATION AND CENTRAL EFFECTS OF TRIHALOMETHANES. I. BRO-MOFORM, Instituto de Quimica Bio-Organica, Barcelona

For primary bibliographic entry see Field 5C. W87-00831

5B. Sources Of Pollution

SEDIMENTATION, NUTRIENT ACCUMULA-TION, AND EARLY DIAGENESIS IN LOUISI-ANA BARATARIA BASIN COASTAL MARSHES,
Louisiana State Univ., Baton Rouge. Center for

Wetland Resources.
For primary bibliographic entry see Field 2L.
W87-00018

EMISSIONS OF SULFUR GASES TO THE AT-MOSPHERE FROM ESTUARIES AND COAST-AL AREAS.

Drexel Univ., Philadelphia, PA. Dept. of Chemis For primary bibliographic entry see Field 2L.

Sources Of Pollution-Group 5B

FATE OF NUCLIDES IN NATURAL-WATER

SYSTEMS, Yale Univ., New Haven, CT. Dept. of Geology and Geophysics K. K. Turekian

A. A. Turetam.
Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-003060, Price codes: AQ2 in paper copy, AQ1 in microfiche. Report No. DOE/EV/13573-32, November 30, 1982. Annual Progress Report. 5 p. DOE Grant DE-AC02-76EV13573.

Descriptors: *Radioactive tracers, *Fate of pollut-ants, *Radioactive dating, *Natural waters, *Fate of nuclides, *Isotopic studies, *Lead, radioisotopes, Beryllium radioisotopes, Uranium radioisotopes, Thorium radioisotopes, Precipitation, Deposistion, Soil profiles, Groundwater, Acquisition.

Soil profiles, Groundwater, Acquisition.

Both the land and the sea are sources of energy and repositories of the consequences of man's use of energy. They are, however, not isolated from each other. Transport by streams and the air inex-orably couple land and sea. Man has added to these natural couriers our capacity to transport goods and wastes to and across all parts of the world. A proper study of the environmental effects of energy use should consider the coupled nature of all these systems. This will provide a balanced view of the consequences of impacting the land and the sea with energy related activities. The approach has been to look at each of these systems with the techniques which are believed to be valuable in tracing the behavior of nuclides in natural waters. Using 210-Pb standing crop in soils, one can obtain the precipitation and deposition flux of 210-Pb from the atmosphere. This provides a method of determining the flux of other chemical species, such as Pb, dust and sulfate, to the surface. Recent work has concentrated on the orographic effects of aerosol deposition. Another cosmogenic isotope, 10-Be, with a half-life of 1.5 million years, has also been studied, particularly the distribution of 10-Be in soil profiles. The initial aim was to use the standing crop of 10-Be in the soil to obtain an exposure age of the surface. Date surfaces (i.e. of 10-Be in soil profiles. The initial aim was to use the standing crop of 10-Be in the soil to obtain an exposure age of the surface. Date surfaces (i.e. raised coastal terraces, dated volcanic flows, etc) showed that 10-Be does not totally accumulate in the soils (all from California) but is mobilized. The mean residence time appears to be about 20,000 years. In a related study, members of the 238-U and 232-Th decay series nuclides in the major ground water aquifer types in Connecticut, were measured. Using 222-Rn as a flux indicator, the adsorption and desorption coefficients, distribution coefficients and retardation factors of Ra, Pb and Th in these aquifers, have been determined. (See also W87-00005) (Lantz-PTT)

ACID DEPOSITION IN TEXAS: TECHNICAL SUMMARY AND PERSPECTIVE, VOLUME II, Espey, Huston and Associates, Inc., Austin, TX. J. A. Levy.
Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-900817, Price codes: A06 in paper copy, A01 in microfiche. Report No. TENRAC/EDF-057-Vol. 2, January 15, 1982. Final Report. 160 p, 2 fig, 15 tab, 180 ref. Project 80-L-11-6.

Descriptors: *Acid rain, *Texas, Air pollution, Air pollution effects, Vegetation effects, Surface water, Water pollution effects, Ecological effects, Ecosys-

This report has been written to serve as a resource document in developing an acid-deposition work plan for the State of Texas. It provides a summary of the available technical information concerning critical aspects of the acid-deposition question as they relate to Texas. Data and information presented in this report were used to qualitatively evaluate acid deposition in Texas and to place the issue into the proper perspective relative to other areas of the United States. The available body of knowledge suggests that acid deposition is not a problem of immediate concern throughout most of Texas. Monitoring of precipitation chemistry is currently being conducted at several sites in Texas, primarily in the eastern part of the state. Discussed are not only the origins, transport, transformation and re-

moval, of acid deposition in Texas, but also the effects of this deposition on local surface waters, vegetation and aquatic ecosystems. Texas differs significantly with respect to acid deposition from more thoroughly investigated areas of the U.S. (the eastern and northeastern parts of the country and the Los Angeles Basin). There is no predominant category of anthropogenic emission sources in this state. In general, the physical environment in Texas is less sensitive to potential acid deposition effects than that found in the northeastern U.S., and the meteorology of the state is substantially different from that of other parts of the country. These differences suggest that the chemistry associated with the formation and removal of acid deposition in Texas is probably unlike that investigated in other area. Although the same general chemical mechanisms are present in Texas, the reaction, transformation, and deposition rates differ and the relative importance of individual mechanisms may likewise be different. In particular, the dry deposition of acidic substances appears to be of equal or greater magnitude than acid precipitation. (Lantz-PTT)

CLOUD WATER: AN IMPORTANT VECTOR OF ATMOSPHERIC DEPOSITION, Oak Ridge National Lab., TN. Environmental Sci-

ences Div.

ences Div. G. M. Lovett, and W. A. Reiners. Available from the National Technical Information Service, Springfield, VA. 22161, as DE82-064646, Price codes: A02 in paper copy, A01 in microfiche. Report No. CONF-821136-6, November 1982. 9 p. 1 fig. 3 tab, 25 ref. NSF Grant No. DE79-07346.

Descriptors: *Clouds, *Fogs, *Atmospheric depo-sition, *Path of pollutants, Acid rain, Air-earth interfaces, Advected fogs, Agnalachian Mountains, Trace metals, Sulfur, Nitrogen, Precipitation, Orographic precipitation.

Cloud water deposition is an important vector of water and chemical input to the subalpine ecosys-tems of the northern Appalachians and is probably important in other mountainous and seacoast areas water and chemical input to the subalpine ecosystems of the northern Appalachians and is probably important in other mountainous and seacoast areas as well. This paper studies advected fogs, using the following techniques: (1) modelling cloud water deposition, and (2) chemical analysis of cloud waters of the control of

TECHNICAL BACKGROUND INFORMATION FOR THE ENVIRONMENTAL AND SAFETY REPORT, VOL. 5: THE 1977 CLINCH RIVER SEDIMENT SURVEY - DATA PRESENTA-

TION,
Oak Ridge National Lab., TN.
T. W. Oakes, W. F. Ohnesorge, J. S. Eldridge, T.
G. Scott, and D. W. Parson.
Available from the National Technical Information
Service, Springfield, VA. 22161, as DE83-003350,
Price codes: Al Oin paper copy, A01 in microfiche.
Report ORNIL-5878, November 1982. 313 p. 24 fig.,
17 tab, 15 ref, 1 append. Contract No. W-7405-eng-

Descriptors: *Clinch River, *Water quality monitoring, *Sediments, *Data collections, *Radioactive wastes, *Tennessee, Data interpretations, Path of pollutants, Water pollution sources, High-resolution gamma-ray spectroscopy, Environmental impact statement, Cesium, Cobalt, Spectroscopy Strontium, Americium, Curium, Plutonium.

Sources Of Pollution—Group 5B

Since the establishment of Oak Ridge National
Laboratory (ORNL) at the X-10 site in 1943, radioactive materials have been and are being released into the White Oak and Melton Branch
basins and have entered their drainages. The radioactive materials are transported downstream and
into the Clinch River. The releases are the result of
normal plant discharges, sewage outfalls, and seepage from both liquid-waste disposal areas (ponds,
pits, and trenches) and solid-waste burial grounds.
Part of the radioactivity becomes associated with
the bottom sediments by absorption on both clays
and suspended particulates, which ultimately settle
out. By measuring the accumulation of radioactive
materials in the bottom sediments, information can
be obtained regarding the dispersal or reconcentration of wastes in the environment. Samples from
cores in the Clinch River Basin inventory study
were analyzed by high-resolution gamma-ray spectroscopy (137-Cs and 60-Co) and by specific radiochemical determination (90-Sr, 239, 240-Pu, 241Am, and 244-Cm). Data from all analyses performed on a given core are presented in tabular
form along with sampling date and location. Tabular data for cores collected in the Tennesse River
follow those for the Clinch River. The Tennesse
cores are also given in an upstream to downstream
order. This procedure is also used for the few
Emory River cores that follow the Tennesse
River cores. In a large number of cores, gammaray spectrometry was the only analysis performed.
Tabular data for 137-Cs and 60-Co at levels below
1 picoCuries (pCi)/G (0.04 becquerel/BQi)/g) have
an associated error estimate of + 30% due to
counting statistics at the 1 gamma level of confidence. At 2 pCt/g (0.07 Bq/g) and above, counting
statistics becomes less important than uncertainties
because of geometry, density, etc. At the highest
levels of activity (> 100 pCt/g (3.7 Bq/g)), the
estimated overall uncertainty (standard deviation)
is + 6%. (Lantz-PTT)
W87-00047

OVERVIEW OF OIL FIELD BRINE PROB-LEMS IN THREE ILLINOIS COUNTIES. Greater Egypt Regional Planning and Develop-ment Commission, Carbondale, IL. For primary bibliographic entry see Field 4C. W87-00048

CONTROL OF GROUND WATER CONTAMI-NATION AT AN ACTIVE URANIUM MILL, Earth-Fax Engineering, Inc., Murray, UT. For primary bibliographic entry see Field 5G. W87-00052

PERMITTING THE MERCUR GOLD MINE TAILINGS POND, Getty Mining Co., Salt Lake City, UT. For primary bibliographic entry see Field 5G. W87-00053

HYDROLOGIC MODELING FOR IDENTIFICATION OF SALINITY SOURCES IN A STREAM-AQUIFER SYSTEM, A CASE STUDY, Utah Water Research Lab., Logan.
M. Sepehr, L. D. James, and C. Duffy.
IN: Proceedings of the Association of Ground
Water Scientists and Engineers: Western Regional
Ground Water Conference, January 15-16, 1985,
Reno, Nevada. 1985. p 156-183, 16 fig. 10 tab, 16

Descriptors: "Hydrologic modeling, "Stream-aqui-fer systems, "Water pollution sources, "Saline water intrusion, Salinity, Sevier River Basin, Colo-rado, Perolotition, Model studies, Recharge, Cost analysis, Water pollution control.

A large downstream increase in dissolved solids concentration in surface and subsurface waters is observed in the Sigurd Subbasin of the Sevier River Basin, Colorado. Electrical conductivity of the river water during the low flow asson increases from < 500 micromhoms/cm (25 C) to > 1600 in the 12 miles over the study areas. At the upstream end of the subbasin, deep percolation from irrigation recharges the underlying shallow

Group 5B-Sources Of Pollution

aquifer, eventually returning to the river as base-flow. Significant salinity increases are observed in the downstream aquifers as a result of contact with saline sedimentary strata. A model study of this complex stream-aquifer system has combined ap-plications of: a surface and soil-water routing model (the BSAM-SALT model) to estimate river, polications of: a surface and soil-water routing model (the BSAM-SALT model) to estimate river, irrigation and lateral basin recharge and, the USGS Modular Ground Water Model in both steady-state and transient modes to represent salt movement through the system. Decomposition of a complex, multi-layered, stream-aquifer system into the components and then computing recharge a regional flow and salt balance pattern by applying groundwater flow and solute transport models proved an effective procedure for understanding the complex stream-aquifer system. Application of the surface routing hydrologic model provided input to the three-dimensional groundwater model and a water balance in whole aquifer system was computed. Both strady-state and transient calibration of the groundwater model was performed. By application and calibration of the transport model the salt contribution from different sources such as the saline Arapien shale and irrigation return flow were identified. A management strategy was developed which provided for river augmentation by pumping from low salinity regions in the aquifer Effectiveness of this strategy as a salinity control measure was evaluated by the groundwater flow and transport models. The pumping costs for different levels of salinity control were analyzed and the effects of the withdrawals on the shallow aquifers were simulated. (See also W87-00049) (Author's abstract)

SOLUTE TRANSPORT IN A GROUNDWATER SYSTEM WITH REVERSING REGIONAL GRA-

Nevada Univ. System, Reno. Water Resources Center.

For primary bibliographic entry see Field 2F.

MODELING OF FLOW AND CONTAMINANT TRANSPORT IN FRACTURED ROCK RELAT-ED TO HIGH-LEVEL NUCLEAR WASTE RE-

POSITORY, Nevada Univ. System, Reno. Water Resources Center Z. Panahi.

Z. Franan.
IN: Proceedings of the Association of Ground
Water Scientists and Engineers: Western Regional
Ground Water Conference, January 15-16, 1985,
Reno, Nevada. 1985. p 206-219, 1 tab, 31 ref.

Descriptors: *Model studies, *Path of pollutants, *Fractured rock, *Radioactive waste disposal, Computer models, Saturated flow, Fracture per-meability, Unsaturated flow, Yucca Mountain,

Computer models that can be used to analyze and predict the performance of a high-level nuclear waste repository emplaced in fractured rock for the model selection are saturated-unsaturated flow, chemical transport, heat transfer, and geomechanical process. The models are addressed with the capability of simulating one or more of the above processes in fractured porous media. The possible applicability of the models to the near-field, mesofield, and far-field of a repository setting are discussed. Specific interest is in the applicability of the models to the unsaturated geologic formation of the Yucca Mountain proposed high-level repository in Nevada and the capability for evaluation and analysis of the performance of the geohydrologic system of the site as a high-level radioactive waste repository. (See also W87-00049) (Author's abstract) abstract) W87-00057

GROUND WATER ASSESSMENTS UNDER THE RESOURCE CONSERVATION AND RE-COVERY ACT

Environmental Protection Agency, Denver, CO. Region VIII. For primary bibliographic entry see Field 5G.

W87-00058

PREVENTING GROUND WATER CONTAMINATION FROM UNDERGROUND STORAGE TANK SYSTEMS, ital Protection Agency, Denver, CO.

For primary bibliographic entry see Field 5G. W87-00059 Region VIII.

NEW LOOK AT THE SALT LOAD OF THE RIO SALADO, NEW MEXICO, Bureau of Indian Affairs, Albuquerque, NM. Albu-

querque Area Office. W. D. White.

W. D. White.

In: Proceedings of the Association of Ground
Water Scientists and Engineers: Western Regional
Ground Water Conference, January 15-16, 1985,
Reno, Nevada. 1985. p 332-347, 5 fig, 2 tab, 10 ref.

Descriptors: *Rio Salado, *New Mexico, *Salinity, *Water pollution sources, Jemez River, Rio Grande, Dissolved solids, Path of pollutants, Trav-ertine, Springs, Water sampling, Sulfates, Chloride, Wells.

Wells.

The Rio Salado, north-central New Mexico, spans the San Juan Basin Nacimiento Uplift contact, marked by extensive travertine deposits associated with the Pajarito Fault. The Rio Salado has long been recognized as a source of high dissolved loads for the lower Jemez River and Rio Grande. Structurally controlled travertine springs west of San Ysidro and along the Arroyo Penasco are principle contributors to the dissolved load of the Rio Salado Not previously discussed in the literature is the possible contribution of salt from overland flow off approximately 14 sq mi of gypsum outcrop as the Rio Salado follows the dip slope of the Jurassic age Todilto Formation. Base flow of the Rio Salado was sampled through its strike-valley reach to document changes in water quality. A flow diagram of chloride loading shows that the travertine springs and an abandoned flowing well are the principle sources of the dissolved load. Dissolution of the Todilto outcrop adjacent to the Rio Salado occurs in its upper reach, but becomes relatively less important downstream due to the influx of sulfate-rich waters in its lower reach. A trillinear plot of spring and surface water samples suggest a deep rezional flow system from the San influx of sulfate-rich waters in its lower reach. A trilinear plot of spring and surface water samples suggest a deep regional flow system from the San Juan Basin is the source for the travertine springs. The same system discharges over a large area, including the channel of the Rio Salado and at Ojito Spring, six miles west of Arroyo Penasco. The probable source of the sodium sulfate rich waters are deeply buried Paleozoic rocks of the San Juan Basin. Geothermal waters of the Jemez Mountain type are not seen in the Rio Salado. (See Mountain type are not seen in the Rio Salado. (See also W87-00049) (Author's abstract)

LONG-TERM HYDROLOGIC MONITORING PROGRAM: GNOME SITE, EDDY COUNTY,

NEW MEXICO.
Department of Energy, Las Vegas, NV. Nevada
Operations Office.
Available from the National Technical Information
Service, Springfield, VA. 22161, as DE33-004131,
Price codes: A03 in paper copy, A01 in microfiche.
Report No. NVO-241, 1982. 29 p, 9 fig, 2 tab, 20

Descriptors: *Nuclear explosions, *Water quality, *Groundwater pollution, *Monitoring, *Gnome Site, *New Mexico, *Radioactivity effects, Radioactivity, Public health, Legal aspects, Cleanup operations, Geohydrology, Information exchange,

The Gnome site is located in Eddy County, approximately 31 miles southeast of the city of Carls-bad, New Mexico. Project Gnome, with a yield of 3.1 kilotons, was detonated December 10, 1961. It 3.1 kilotons, was detonated December 10, 1961. It was the first nuclear detonation designed specificially for peaceful purposes and the first underground event of the Plowshare Program to take place outside the Nevada Test Site. The purpose of the Long-Term Hydrologic Monitoring Program at the Gnome site is to obtain data that will assure

the public safety; inform the public, the news media, and the scientific community relative to radiological contamination; and to document compliance with federal, state, and local antipollution requirements. The Gnome site geographical setting, climate, geology, and hydrology are described. Site history, including Gnome event information and pre-and post-Gnome monitoring by the U.S. Public Health Service and the USGS, is described. Site cleanups of 1968 and 1979 are described. Postoperational surveys indicate that the Gnome site is well below the established decontamination criteria and that no hazard exists or will likely occur during public use of the surface of the Gnome site. The Long-Term Hydrologic Monitoring Program for the Gnome site is described. (Author's abstract) W87-00066

DOCUMENTATION OF SED-A SEDIMENT/ WATER COLUMN CONTAMINANT MODEL, National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental For primary bibliographic entry see Field 5C. W87-00073

CHEMICAL CONTAMINANTS IN EDIBLE, NON-SALMONID FISH AND CRABS FROM COMMENCEMENT BAY, WASHINGTON, Environmental Protection Agency, Seattle, WA.

Region X.
A. R. Gahler, J. M. Cummins, J. N. Blazevich, R.
H. Rieck, and R. L. Arp.
Available from the National Technical Information
Service, Springfield, VA. 22161, as PB83-172163,
Price codes: A06 in paper copy, A01 in microfiche.
Report No. EPA-910/9-82-093, December 1982.
118 p, 1 fig, 4 tab, 13 ref, 4 append.

Descriptors: *Chemical analysis, *Water pollution, *Fish, *Crabs, *Commencement Bay, *Washington, Puget Sound, Discovery Bay, Tissue analysis, Mercury, Polychlorinated biphenyls, DDT, Heavy metals, Organic compounds.

metals, Organic compounds.

A survey of chemical contaminants in fish and crabs from Puget Sound's Commencement Bay area was initiated following reports by various agencies that certain waterways in the area contained relatively high levels of potentially toxic chemicals. Information was collected to provide the Tacoma-Pierce County Health Department with chemical data needed to begin a preliminary assessment of any health risk possibly faced by persons eating fish and crabs from Commencement Bay and adjacent waters. Sampling was conducted from July 1981 to January 1982. Eighty-six non-salmonid fish and six Dungeness crabs were collected from popular sport fishing locations in the vicinity of Commencement Bay and from a remote reference area, Discovery Bay. Muscle tissue from these specimens was chemically analyzed for selected metals and organic compounds (EPA priority pollutants). Specimens from the Commencement Bay area generally had higher contaminant levels than did the specimens collected from Discovery Bay. The pollutant concentrations in the fish and crabs varied considerably, depending on the species and their location. The highest concentrations of polychlorinated biphenyls (PCB's) and pesticides were measured in fish from the Hylebos Waterway, while the highest total metal concentrations measured in fish were found in flafish from the Point Defiance Dock. Regardless of where the crabs were collected, they contained total metal concentrations several times higher than the highest levels detected in fish. The mercury, PCB, and DDT concentrations measured were always well below the tolerance or action levels estabalished by U.S. Food and Drug Administration (EPA). Heaves ry, PCB, and DDT concentrations measured were always well below the tolerance or action levels estabalished by U.S. Food and Drug Administration (FDA). However, few specific guidelines are available to assist in the direct assessment of the potential toxicity of many individual chemicals detected. The existing guidelines also do not address possible combinations of chemicals and metabolities. No attempt was made in this report to continue the action of the potential process. possible combinations of chemicals and lites. No attempt was made in this report to conduct an overall assessment based on these data. (Author's abstract)

Sources Of Pollution—Group 5B

LONG-TERM HYDROLOGIC MONITORING PROGRAM, AMCHITKA ISLAND, ALASKA. Department of Energy, Las Vegas, NV. Nevada Operations Office.
For primary bibliographic entry see Field 7A.
W87-00080

EFFECTS OF WASTE DISPOSAL ON GROUNDWATER AND SOURCE WATER.
International Association of Hydrological Sci-For primary bibliographic entry see Field 5C. W87-00126

DETERMINATION OF THERMAL POLLU-TION OF THE RIVER MEUSE, Utrecht Rijksuniversiteit (Netherlands). Dept. of Utrecht Rijksuniversiteit (Netherlands). Dept. of Geography.
C. J. Schouten, and H. A. R. de Bruin.
IN: Effects of Water Disposal on Groundwater and Surface Water. LAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 49-62, 4 fig, 5 tab, 12 ref.

Descriptors: *Thermal pollution, *Meuse River, *Water pollution identification, Mathematical equations, Mathematical models, North Sea, Natural waters, Physical models.

The thermal pollution of the River Meuse is considered using three methods for the determination of the natural water temperature (T sub N) which is defined as the temperature her river would have under undisturbed circumstances. The first two methods consist of a simple comparison of the measured (annual mean) river temperature with the corresponding values of (a) the air temperature observed at a nearby weather station, and (b) the temperature of the North Sea at a location which is not thermally polluted. For these comparisons use is made of long term records of air and water temperatures since 1910. The third method is a physical technique. With a physical model the natural water temperature; humidity and wind speed. Assuming that there was a negligible thermal pollution before 1928 it is found that on an annual basis T sub N can be calculated with T sub N - T sub a + 2 and T sub N = T sub s + 1(K), where T sub a and T sub s are the air and North Sea temperature respectively. It is concluded that the T sub n values evaluated with the physical model compare well with the T sub N's obtained from the mean air or mean North Sea temperatures. The physical model has the advantage that it is applicable over a shorter time interval than 1 year. The calculations show a temperature increase of about 2.5 K at Masstricht since 1910. (See also The thermal pollution of the River Meuse is conyear. The calculations show a temperature increase of about 2.5 K at Maastricht since 1910. (See also W87-00127) (Author's abstract)

BOTTOM SEDIMENT CHEMISTRY AND WATER QUALITY NEAR MOUNT EMMONS, COLORADO,

COLORADO,
Woodward-Clyde Consultants, Denver, CO.
T. D. Steele, and T. H. Coughlin.
IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 63-78, 5 fig, 1 tab, 33 ref.

Descriptors: *Bottom sediments, *Water quality, *Mount Emmons, *Chemical analysis, Colorado, Trace metals, Mine wastes, Streamflow, Molybdenum, Arsenic, Coal Creek, Iron, Manganese, Zinc.

Reconnaissance surveys of selected trace-metal concentrations of bottom sediments of two streams in the vicinity of Mount Emmons in south-central Colorado were made during August 1980 and July 1981. Mineral mining has occurred in the study area in the past, and development of a new molybdenum mine is planned. Associated treatment of existing and projected mine drainage along with the construction and operation of mine facilities

may alter the streamflow and water quality regimes. The data from the reconnaissance surveys were compared to recent water quality data at sites along the same stream reaches. The largest concentrations of arsenic in both water and bottom sediments in both surveys were measured for samples trations of amenic in both water and outom sectiments in both surveys were measured for samples near the headwater reach of Coal Creek, which is approximately 3 miles upstream from the proposed mining activity. Iron concentrations in bottom sediments were slightly greater at sampling sites near the headwaters of both streams and were substratively according to the control of the section of the streams and were substratively according to the streams and the streams and the streams and the streams are substratively according to the streams and the streams are substratively according to the streams and the streams are substratively according to the streams and the streams are substratively according to the streams and the streams are substratively according to the streams and the streams are substratively according to the streams and the streams are substratively according to the streams are substratively according to the streams and the streams are substratively according to the stream according to the streams are substratively according to the s substantially greater at sites downstream from an old mine discharge into Coal Creek. Stream prosubstantially greater at sites downstream from an old mine discharge into Coal Creek. Stream profiles for manganese and zinc concentrations in bottom sediments gradually increased in a downstream direction along Coal Creek, in contrast to the abrupt increase in concentrations of these trace metals for water samples collected downstream from the old mine discharge. Trace-metal concentrations in bottom sediments tended, in general, to be greater for the 1981 survey compared to the 1980 survey, which may have reflected both the below-normal streamflow that occurred during 1981 relative to above-normal streamflows during 1981 relative to above-normal streamflows during 1980, as well as the influence of a sequestriant agent or possibly a residual polymer introduced with the discharge of a heavy metals treatment plant. Profiles of bottom sediment trace-metal concentrations tend to depict a more integrated description of lithological factors affecting water chemistry in contrast to the more highly variable concentrations with season in water. (See also W87-00127) (Author's abstract)

SOLUTE MOVEMENT IN UNSATURATED SOILS UNDER INTERMITTENT CONDI-

New South Wales Univ., Kensington (Australia). School of Civil Engineering. For primary bibliographic entry see Field 2G. W87-00133

DYNAMIC NITROGEN BALANCE MODEL FOR RIVER SYSTEMS, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 2K. W87-00134

BROMIDE IN URBAN RUNOFF - WATER QUALITY CONSIDERATIONS, Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering. C. J. Sollars, C. J. Peters, and R. Perry. IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 101-112, 2 fig, 2 tab, 19 ref.

Descriptors: *Bromide, *Urban runoff, *Water quality, Path of pollutants, Trihalomethanes, Roads, Runoff precipitation, Air pollution, Lead, Water pollution sources.

Water pollution sources.

The significance of bromide present in urban runoff and its impact on water quality with respect to trihalomethanes (THM) in water supplies is discussed. A well-defined road catchment has been used to examine the occurrence and sources of bromide in runoff, precipitation and air. In urban areas, traffic density will generally be lower than on a major motorway and the rate of initial lead particulate emission and deposition therefore lower, except on the busiest routes. On motorways, however, traffic generated turbulence and generally more exposed conditions will serve to significantly disperse deposited dust and particulate matter away from the road surface, while in more congested urban areas these effects will be greatly reduced. Roadside dust in urban areas has, in addition, been shown to contain lead contents in a range very similar to those found in this work and others. Moreover, the general range of lead concentrations found in urban runoff is at least as high as those encountered in this work. Very few data are to concentrations found in urban urnoff is at least as high as those encountered in this work. Very few data are to concentrations to contract a broad in the work and contractions of the contraction to the centrations found in uroan runoit is at least as night as those encountered in this work. Very few data exist concerning bromide levels in urban runoff, but in view of the relationship between lead and bromide it is to be expected that runoff from urban

areas will contain similar levels to those found in motorway runoff. Thus urban runoff must be seen as a potentially major source of bromide in surface waters, especially during summer after periods of prolonged dry weather when a reasonably intense rainstorm over a large urban area may contribute a very significant increase in flow and bromide load to a receiving water under conditions of dry weather flow. This has clear implications for water quality and THM formation during water treatment. (See also W87-00127) (Lantz-PTT)

POLLUTION POTENTIAL OF SANITARY

Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Stadtb

inst. tuer Stationawesen.
R. Stegman.
IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 125-135, 5 fig. 3 tab, 6 ref.

Descriptors: *Sanitary landfills, *Groundwater pollution, *Solid waste disposal, Leachates, Organic compounds, Inorganic compounds, Sewage gas.

Most of the municipal solid waste (MSW) today is disposed of in sanitary landfill. Although landfill has been used for a very long time, little has been done to optimize landfill operation techniques in order to minimize emission rates. The deficiency in order to minimize emission rates. The deficiency in knowledge concerning the processes that take place in sanitary landfill is one reason for this situation. Dependent upon its nature, soil beneath sanitary landfill is contaminated with organic and inorganic compounds from leachate. In addition gas generated from the landfill can migrate through the soil causing additional problems. This is exacerbated if landfill sites are not sealed, but it should be taken into consideration that liners are rarely completely impervious. Leachate productions and the sealed production of the sealed production. snould be taken into consideration that mers are rarely completely impervious. Leachate produc-tion rates and data on leachate quality data are presented. Gas emission data are considered and procedures for minimizing these by optimizing landfill techniques are discussed. (See also W87-00127) (Lantz-PTT) W87-00137

INVESTIGATIONS INTO DOMESTIC REFUSE LEACHATE ATTENTUATION IN THE UN-SATURATED ZONE OF TRIASSIC SAND-

Severn-Trent Water Authority, Birmingham (Eng-

R. C. Harris, and E. L. Perry. IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 147-155, 3 fig.

Des^riptors: *Domestic wastes, *Leachates, *Aeration zone, *Sandstone, Groundwater pollution, Aquifers, Waste disposal, Groundwater movement, Water table, Groundwater management.

Groundwater resources are of great importance in Severn-Trent Water Authority's region and the Authority has taken a cautious view of domestic landfill on the major aquifers, because of the pollution risk. This attitude has had to be adopted on inadequate technical information and so the Authority initiated its own research program to investigate attenuation processes within the unsaturated zones of varying depth. Cored boreholes were sunk through the refuse and sandstone, and into the water table. The pore water was extracted and analyzed, such that a profile of a leachste front moving down below each site was obtained. Repeat coring was carried out after approximately two years and spatial and temporal changes in the front were observed. The results show that there is little attentuation of leachate, which has migrated through some 5 to 6 m of unsaturated zone. This evidence conflicts with widely held views to the evidence conflicts with widely held views to the contrary. The vertical migration rate for the leach-

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ate at both sites is estimated to be between 1 and 2 m/yr, a value consistent with accepted data for the Triassic sandstones. (See also W87-00127) (Lantz-PTT) W87-00139

BEHAVIOUR OF CYANIDE IN A LANDFILL AND THE SOIL BENEATH IT,

Rijksinstituut voor Drinkwatervoorziening, Leids-chendam (Netherlands).

chendam (Netherlands).
P. Lagas, J. P. G. Loch, and K. Harmsen.
IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 169-178, 3 fig. 3 tab, 10 ref.

Descriptors: *Cyanide, *Landfills, *Leaching, *Soil contamination, Experimental design, Soil columns, Domestic waste, Industrial wastes, Nether-

The behavior of cyanide in a landfill and the soil The behavior of cyanide in a landfill and the soil was studied because at several locations in the Netherlands, heat treatment waste from metal processing firms, containing cyanide, was dumped in codisposal with domestic waste. Experiments were set up to study the behavior of cyanide under controlled conditions, with six columns of 110 cm length and a diameter of 18 cm. The columns were filled with a sand layer, on ton of which a layer of filled with a sand layer, on top of which a layer of ground domestic waste was placed. A layer of 25 g of cyanide was embedded in the waste. Special attention was given to the influence of the loc the cyanide-containing waste in the waste layer and the influence of the groundwater level on the behavior of cyanide. The results indicate that 4behavior of cyanide. The results indicate that 4-22% of the cyanide leached out of the column as free or complex cyanide, while 4 to 11% of the added cyanide remained in the column, probably as Prussian blue. Between 72 and 82% of the cyanide was converted, mainly to ammonium and organic nitrogen compounds. (See also W87-00127) (Author's abstract) W87-00141

ORIGIN AND FORMATION OF THE UNDER-GROUND WATER POLLUTION IN XIAN, First Hydrogeology Team of Shaanxi Province, Xian (China).

D. Fakai. D. Pakan.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 179-182, 2 tab.

Descriptors: *Groundwater pollution, *Path of pollutants, *Water pollution sources, Fluorine, Nitrogen, Organic compounds, Leaching, Water pollution prevention, Recycling, China, Hydrogen ion

Pollution of groundwaters by nitrogen and fluorine is used to illustrate the origin and expansion of contamination. The bacterial mineralization of organic residues in the soil, to produce nitrate and other nitrogen species, is considered to be the chief cause of nitrogen pollution. Insoluble calcium fluoride in the soils is mobilized by acidic waste water irrigation and then leaches to and contaminated. ride in the soils is mobilized by acidic waste water irrigation and then leaches to, and contaminates, the groundwater zone. At the present time groundwater pollution in Xian is serious, and the following measures are proposed to protect groundwater resources: (a) Improvement of the treatment and anaagement of the city wastes, especially the treatment and recycling of wastewater. Set limits to the concentrations of discharge and the quantities of discharges. (b) Set a limit to the use of irrigation water so as to restrict its pollution of soils and groundwater. (c) Control the pH value of wastewater to reduce induced pollution. (d) Limit the use of groundwater resources to prevent over the use of groundwater resources to prevent over extraction and deterioration of water quality. (e) Enhance scientific research into environmental protection and pollution control. Make a comprehensive plan for environmental control. (See also hensive plan for environmental control. (See W87-00127) (Lantz-PTT) WR7-00142

WASTE DISPOSAL IN SCOTLAND AND ITS EFFECTS ON GROUND AND SURFACE Forth River Purification Board, Edinburgh (Scot-

For primary bibliographic entry see Field 5D. W87-00143

CASE STUDY ON NON-POINT SOURCE PLANT NUTRIENT LOAD CALCUATIONS, Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-

Vizgazatakodasi Tudomanyos Kutato Intezet, Budapest (Hungary).

G. G. Pinter, and G. Jolankai.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 207-214, 3 fig.

Descriptors: *Nonpoint pollution sources, *Nutrients, *Pollution load, *Case studies, Agricultural runoff, Model studies, Water quality, Monitoring, Pertilizer, Rainfall intensity.

The possibilities of modelling non-point source runoff contribution to the pollution load of recipient surface water bodies has been analyzed using the data from a regular water quality monitoring network and also that of objective oriented field studies. The relevant literature is also briefly reviewed and evaluated from the point of view of practical applicability. Experimental regression type approaches are discussed in detail. Conclusions of this study are in fact questions, such as those listed here: (a) effects of fertilizer application on the yield rate (literature values are scare and on the yield rate (literature values are scare and contradicting), (b) effects of grazed and large scale animal husbandry and manure application (very contradicting), (b) effects of grazed and large scale animal husbandry and manure application (very broad ranges scattering results, no quantifiable re-lationship), (c) seasonal effects (effects of vegeta-tion cover), do not conform with other literature yield ranges, (d) effects of rainfall - runoff intensity (it is known but not yet quantified that high inten-sity rainfalls and the resulting 'peaky' floodwaves cause export rates much higher than those derived by the above runoff-yield rate equations). These and such other unknown effects could be quanti-fied on the basis of experimental data of several and such other unknown effects could be quantified on the basis of experimental data of several sub-drainage basins by using bi- and multi-variable regression techniques. International efforts on the development of such quantifiable relationships are under way in the framework of the UNESCO Man and Biosphery - 5 Working Group on land use impacts on aquatic systems, and it is hoped that generalized quantitative relationships covering a broad range of human activities and natural drainage basin characters will be available in the near future. (See aiso W87-00127) (Lantz-PTT) W87-00145

MODELLING OF POLLUTION-TRANSPORT IN AQUIFERS - INFLUENCE OF THE STRUC-TURAL VARIATION, Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-

dapest (Hungary).

dapest (Hungary).
G. Kovacs.
IN: Effects of Water Disposal on Groundwater
and Surface Water, IAHS Publication No. 139,
1982. Proceedings of a Symposium held during the
First Scientific General Assembly of the IAHS at
Exeter, England, July 19-30, 1982. p 215-234, 15
fig, 2 tab, 5 ref.

Descriptors: *Groundwater movement, *Ground-water pollution, *Hydrologic models, Aquifers, Porous media, Dispersion, Mathematical models, Statistical analysis, Model studies.

The objective of the investigation was to find a method for describing dispersion in porous media, which can be easily applied in practice and is capable of expressing properly the effects of the structural properties of the layer. Considering the role of mechanical dispersion, a set of physical models was constructed to simulate both the steady state of dispersion and the time-variable spreading of pollution. The concentration-distribution and the breathrough curve can be calculated from the equations on the basis of the models. The reliability of the method was proved by experi-

ments. From the measured data even the relation-ship between the model parameters and the physi-cal properties of the layer was determined. Finally the influence of the structural variation of the porous medium on dispersion was investigated. The models, which give only the expected mean-value of concentration, were supplemented by determining the probable variance of concentration at a given point. (See also W87-00127) (Author's abstract) W87-00146

STEADY AND NON-STEADY FLOW MODELS FOR SIMULATION OF WATER QUALITY IN PIVERS.

Instituto de Pesquisas Hidraulicas, Porto Alegre (Brazil)

(Brazil).

C. E. M. Tucci, and L. Moretti.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 235-244, 4 fig.

Descriptors: *Mathematical models, *Water quality, *Steady flow, *Unsteady flow, Simulation, Rivers, Sinos River, Brazil, Biological oxygen demand, Dissolved oxygen, St Venant equations.

Models for unsteady conditions were developed by improving the solution of St. Venant equations due to the need to solve an estuary type of problem. An unsteady water quality model which solves flow equations through a forward implicit finite difference scheme and the transport equation by a backward implicit finite difference scheme is compared to the QUAL-I model which is a steady flow model. The comparison is done on the Sinos River (Brazil), a highly polluted river, based on the BOD and DO water quality parameters. Sources of pollution were evaluated and the level, flow and water quality parameters were recorded at time and DO water quality parameters. Sources to pol-lution were evaluated and the level, flow and water quality parameters were recorded at time intervals. The water quality in water courses where the flow changes continuously due to downstream tidal effects cannot be accurately sim-ulated by steady flow transport models. The criti-cal condition, which is a low flow upstream, in-creases the tidal influence upstream of the river mouth. For the River Sinos, this upstream flow direction increases the river oxygen capacity during the inversion flow period because the delta downstream has a high oxygen concentration, but it could be worse if the situation were inverted. The steady flow solution which under-estimated the DO concentration was unreliable. If it were used in order to design treatment plants, cost would be higher. (See also W87-00127) (Lantz-PTT) PTT) W87-00147

EFFECTS OF COAL MINE WASTES OF NORDRHINE-WESTPHALIA ON GROUND-

WATER,
Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
For primary bibliographic entry see Field 5C.
W87-00150

PRELIMINARY ASSESSMENT OF THE RE-FRELIMINARY ASSESSMENT OF SELECTED BASALT FLOWS AT THE HANFORD SITE, WASHINGTON, USA, Texas A and M Univ, College Station. Dept. of

ue, and P. A. Do Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 151-167, June 15, 1986. 9 fig. 1 tab, 12 ref. Rockwell International Contract No. SA-1023.

Descriptors: *Dispersivity, *Basalts, *Hanford site, *Washington, *Path of pollutants, *Groundwater pollution, Hydraulic properties, Groundwater movement, Flow pettern, Chemical wastes, Mathematical analysis, Model studies.

Dispersivity is one of the hydraulic parameters that controls the distribution in groundwater of chemical constituents migrating from a source region. A

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primary reason why dispersivity has not been analyzed with regional-scale data, is the general lack of suitable environmental tracers that have been in the hydrologic environment for long periods of time. Such tracers could normally result from some natural event, perhaps disruptive, that may have transpired in the geologic past. Such an event may have occurred at the U.S. Department of Energy Hanford Site in the State of Washington, resulting in a chemical enclave of regional proportions. A preliminary interpretation is that the enclave corus immediately down-gradient from a hydraulic barrier, possibly a fault, which may have placed deeper formations in hydraulic connection with the upper basalts. With this hypothesized source for constituents making up the enclave, the observed concentrations are employed in a preliminary attempt to assess the regional dispersivity. This is the single conceptual model being tested in this paper. The mathematical method employed assumes that the concentration data conform to what would be expected of a perfectly symmetrical assumes that the concentration data conform to what would be expected of a perfectly symmetrical enclave, and part of the problem deals with identifying that symmetry. The results obtained are quite reasonable when compared to the range in dispersivities determined in laboratory, tracer, and model-scale studies. (Lantz-PTT)

STUDY OF TRACER MOVEMENT THROUGH UNSATURATED SAND, Vrije Univ., Brussels (Belgium). Lab. of Hydrolo-

gy. For primary bibliographic entry see Field 2G.

KINETICS OF MINERALIZATION OF PHEN-OLS IN LAKE WATER, Cornell Univ. Agricultural Experiment Station,

Ithaca, NY. Dept. of Agronomy S. H. Jones, and M. Alexander.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 5, p 891-897, May 1986. 5 fg, 3 tab, 25 ref. Public Health Services Grant No. ES-07052.

Descriptors: *Fate of pollutants, *Biodegradation, *Phenols, *Lakes, *Mineralization, *Models, *Kinetics, Industrial wastes, Bacteria, Biodegradation, Microbial degradation, Organic compounds, Metabolism, Regression analysis, Mathematical models, Organic matter, Model studies.

models, Organic matter, Model studies.

The kinetics of mineralization of phenol and pnitrophenol in lake water was determined at concentrations from 200 picograms/ml to 5 micrograms/ml. The mineralization data were fit by nonlinear regression to equation for 14 kinetic models that describe patterns of biodegradation by nongrowing cells or by microorganisms growing on either the test chemical or other organic substrates. The kinetics of mineralization of phenol in samples collected in July were best described by first-order models for 0.5 ng of phenol per ml; by Monod-without-growth, logistic, and logarithmic models for 1.0 and 2.0 nanogram/ml to 1.0 micrograms/ml, respectively; by models that assume that the phenol-mineralizing populations do not grow or grow logarithmically or logistically on uncharacterized carbon compounds but metabolize the phenol when present at specified levels; and by a logarithmic model at 5.0 micrograms/ml. Usually < 10% of the phenol C that was metabolized was incorporated into microbial cells or retained by particulate matter in the water at substrate concentrations of 10 nanograms/ml or less, and the percentage increased at higher substrate concentrations. Logistic or logarithmic models were better for water collected at other times of the year. Removal of particles from lake water sampled after heavy runoff from land resulted in a change in kinetics of phenol mineralization. Mineralization of 0.5 nanograms to 1.0 micrograms of p-nitrophenol per ml were best described by the Monod-withgrowth model or the logistic model if p-nitrophenol was the C source for growth. Reasons for model fits and selection are discussed. (Geiger-PITT) W87-00166

EFFECT OF SALINITY GRADIENTS AND HE-EFFECT OF SALINITI GRADIENTS AND IN-TEROTROPHIC MICROBIAL ACTIVITY ON BIODEGRADATION OF NITRILOTRIACETIC ACID IN LABORATORY SIMULATIONS OF THE ESTUARINE ENVIRONMENT,

THE ESTUARINE ENVIRONMENT,
Imperial Coll. of Science and Technology, London
(England). Public Health Engineering Lab.
M. Hunter, T. Stephenson, P. W. W. Kirk, R.
Perry, and J. N. Lester.
Applied and Environmental Microbiology

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 5, p 919-925, May 1986. 4

Descriptors: *Nitrilotriacetic acid, *Salinity, *Estuaries, *Biodegradation, *Detergents, *Fate of pollutants, Microbial degradation, Simulation analysis, Saline water, Eutrophication, Ecosystems, Aquatic bacteria, Flavobacterium, Vibrio, Corynebacterium, Enterobacter.

The biodegradation of nitrilotriacetic acid (NTA), a synthetic replacement detergent builder, in the estuarine environment was examined by using a laboratory estuarine simulation. Two interdependent microccosms were used; each of five vessels was equilibrated with a saline gradient between 1.30 and 17.17%, with the final vessel subsequently being increased to a maximum salinity of 31.6%. Each microcosm was seeded simultaneously with heterotrophic bacterial community throughout the range of salinities for 183 days after a stabilization period. Isolation studies demonstrated that both systems contained four bacterial species, representatives of the genera Vibrio and Flavobacterium and members of the coryneform group and the family Enterobacteriaceae. Total bacterial numbers and species diversity decreased with increased salinity. NTA was administered at low and high concentrations, one concentration to each microinity. NTA was administered at low and high concentrations, one concentration to each microcom, initially with the least amount of saline. Removal of both concentrations of NTA occurred and was attributed to biodegradation after a period of bacterial acclimatization. Subsequent dosing of NTA to vessels of higher salinity demonstrated that biodegradation was incomplete at observed mean salinities of >9.18% at low influent NTA concentrations and >5.08% at high influent NTA concentrations. Therefore, acclimatization was dose dependent. It was concluded that NTA acclimatization at the higher salinities ceased because of salinity stress-induced failure of NTA catabolism and not the disappearance of a particular bacterial species. (Author's abstract)

IN PURE CULTURE WITH 2-PROPANOL AND OTHER ALCOHOLS AS HYDROGEN DONORS, GROWTH OF METHANOGENIC BACTERIA

DONORS, Illinois Univ. at Urbana-Champaign. Dept. of Microbiology. F. Widdel.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 1056-1062, May 1986. 2 fig. 1 tab, 51 ref. DOE Contract No. DE-AC02-80ER 10681.

Descriptors: *Marine sediments, *Aquatic bacteria, *Microbiological studies, *Methane, *Methane bacteria, Alcohols, Anaerobic conditions, Fermentation, Culturing techniques, Bottom sediments.

tation, Culturing techniques, Bottom sediments.

Two types of mesophilic, methanogenic bacteria were isolated in pure culture from anaerobic freshwater and marine mud with 2-propanol as the hydrogen donor. The freshwater strain (SK) was a Methanosprillum species, the marine, salt-requiring strain (CV), which had irregular coccoid cells, resembled Methanogenium sp. Stoichiometric measurements revealed formation of I mol of CH4 by CO2 reduction, with 4 mol of 2-propanol being converted to acetone. In addition to 2-propanol, the isolates used 2-butanol, H2, or formate but not methanol or polyols. Acetate did not serve as an energy substrate but was necessary as a carbon source. Strain CV also oxidized ethanol or 1-propanol to acetate or propionate, respectively; growth on the latter alcohols was slower, but final cell densities were about threefold higher than on 2-propanol. Both strains grew well in defined, bicarbonate-buffered, sulfide-reduced media. For cultivation of strain CV, additions of biotin, vita-

min B12, and tungstate were necessary. The newly isolated strains are the first methanogens that were shown to grow in pure culture with alcohols other than methanol. Bioenergetic aspects of secondary and primary alcohol utilization by methanogens are discussed. (Author's abstract) W87-00172

LITTER DECOMPOSITION PROCESSES IN A FLOODPLAIN FOREST, Emory Univ., Atlanta, GA. Dept. of Biology. D. J. Shure, M. R. Gottschalk, and K. A. Parsons. American Midland Naturalist AMNAAF, Vol. 115, No. 2, p 314-327, April, 1986. 5 fig. 4 tab, 55 ref. ERDA Contract No. AT-(40-1)-2412.

Descriptors: *Forest hydrology, *Litter, *Decomposition, *Flood plain management, *Minerals, Mineralization, Cycling nutrients, Forest water-sheds, Decomposing organic matter, South Carolish

Litter decomposition processes were studied in a floodplain forest in South Carolina. Annual decomposition of mixed leaf species decreased from 85% at the streambank to 58% in the contiguous upland terrace forest. This decrease in weight loss was correlated with reduced flooding and an increase in more resistant litter substrates at the upland terrace. Species-specific studies indicated that sweet gum leaves decomposed more slowly than red maple, black gum, and red ash. Sweet gum leaves had higher initial lignin and cellulose concentrations and larger C:N ratios than the other species. Nutrient release rates from litter varied across the floodplain. Magnesium and K leached quite rapidly within the floodplain, whereas Ca and N losses were more gradual. In contrast, Mg and K losses were less and Ca and N immobilization occurred in the more resistant litter on the unflooded upland terrace. The patterns of nutrient release were generally similar for the four floodplain species tested. Decomposition and recycling appears tight in the sandy, nutrient-poor upland terrace forest. Intrasystem nutrient cycling appears tight in the sandy, nutrient-por upland terrace forest. Mechanisms such as litter burial during flooding and the timing of nutrient mineralization can limit nutrient export from the floodplain forest. (Author's abstract)

EFFECTS OF ORGANIC AMENDMENTS ON SULFATE REDUCTION ACTIVITY, H2 CON-SUMPTION, AND H2 PRODUCTION IN SALT MARSH SEDIMENTS,

EmTech Research Corp., Mount Laurel, NJ. For primary bibliographic entry see Field 2L. W87-00176

METABOLISM OF LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS BY SULFATE-REDUCING BACTERIA IN A DELAWARE SALT MARSH,

EmTech Research Corp., Mount Laurel, NJ. For primary bibliographic entry see Field 2L. W87-00177

MICROBIAL RESPONSE TO CRUDE OIL AND COREXIT 9527: SEAFLUXES ENCLOSURE STUDY,

STUDY,
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.
K. Lee, C. S. Wong, W. J. Cretney, F. A.
Whitney, and T. R. Parsons.
Microbial Ecology MCBEBU, Vol. 11, No. 4, p
337-351, December, 1985. 8 fig. 1 tab, 46 ref.

Descriptors: *Microbial degradation, Biodegrada-tion, Fate of pollutants, *Marine bacteria, *Oil, Organic compounds, Phytoplankton, Oil spills, Dispersants, Radioactive tracers, Environmental tracers, Water pollution effects.

The response of marine bacteria to Corexit 9527, with and without Prudhoe Bay crude oil labeled with n-(1-C14) hexadecane, in a temperate pelagic environment was monitored over 22 days using

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controlled ecosystem enclosurs. The results indicated that Corexit and Corexit-dispersed crude oil stimulated bacterial production by serving as substrates and/or by inducing the release of organic compounds from the indigenous phytoplankton population. highest bacterial standing stock was observed in the enclosure treated with a mixture of Corexit and crude oil, in which a large fraction of the predominant bacterivores were eliminated. Biodegradation appeared to be more significant than abiotic processes in contributing to the loss of low volatility n-alkanes in Corexit-dispersed oil. Twenty-two days following its addition, 50% of the radiotracer was recovered: 3% in the suspended particulate fraction, 10% in sedimentary material, 36% as CO2 and less than 1% in the dissolved organic pool. (Author's abstract)

DISTRIBUTION OF BACTERIA ASSOCIATED WITH VARIOUS SIZES OF PARTICULATE MATTER IN HARIMA-NADA AND HIUCHI-NADA AREAS, SETO INLAND SEA, JAPAN,

NADA AREAS, SETU INLAND SEA, JAPAN, Kochi Univ. (Japan). Faculty of Agriculture. J. Takeuchi, and Y. Hata. Japanese Journal of Ecology, Vol. 35, No. 1, p 49-56, March, 1985. 5 fig. 4 tab, 19 ref. Japanese Ministry of Education, Culture, and Science Grant No. 56030066.

Descriptors: *Bacteria, *Sediments, *Coastal waters, *Particulate matter, *Suspended sediments, Heterotrophic bacteria, Bottom sediments, Decomrteterotrophic bacteria, Bottom sediments, Decomposition, Organic matter, Detritus, Decomposing organic matter, Industrial wastes, Fate of pollutants, Biodegradation, Microbial degradation, Japan, Seto Island Sea.

The size-distribution patterns of bacteria associated with suspended, sinking and sedimented particles were investigated in coastal waters, seawater, newly-formed deposits and bottom mud samples were collected from Harima-nada area, which is highly polluted with industrial wastes, and Hluchinada area, which is contaminated with effluent from a pulp mill. The collected samples were then size-fractionated with nylon meah nets and Nucleone filters to elucidate the relationship between pore filters to elucidate the relationship between the size of particulate matter and the number of associated bacteria. In the seawater collected from Harima-nada area, 50-90% of aerobic heterotrophic bacteria were free-living, while 70-90% of those in the newly-formed deposits or the bottom those in the newly-formed deposits or the bottom mud from the same area were attached to the particles, of which particles having 10-50 microns diameter were most abundant in the bacteria. In a polluted site of Harima-nada area, nearly half of the bacterial isolates from both the newly-formed deposits and the bottom seawater were denitrifying bacteria. In a pulp-contaminated site of Hiuchinada area, a great number of cellulolytic bacteria were found; however, none of them could be detected in a free-living state in the bottom mud samples. (Author's abstract)

SUPPRESSION OF NITRATE FORMATION WTHIN AN EXOTIC CONIFER PLANTATION, Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.

A. B. Cooper. Plant and Soil PLSOA2, Vol. 93, No. 3, p 383-394, 1986. 2 tab, 5 fig, 21 ref.

Descriptors: *Nitrates, *Watersheds, *Pine trees, *Path of pollutants, Central volcanic plateau, Soils, Stream waters, Conifer forests, Pastures.

Nitrate losses and nitrifier activities of two adjacent watersheds in the Central Volcanic Plateau region were compared. The mechanism of nitrifier suppression in soil beneath pine trees was studied. Nitrate-N losses to stream waters and soil inorganic N pools, nitrifying potentials and NO3-N production rates were measured in 2 adjacent watersheds, one used as pasture and the other planted in exotic confer forest. Estimated NO3-N loss to stream waters draining the pine and pasture watersheds were 0.6 kg/ha/yr and 7.6 kg/ha/yr respectively. Ammonium-N pool sizes were not stinificantly different between soils in the 2 watersheds

but NO3-N pools and nitrifyilng potentials were always lower in the pine watershed soil samples. Lsboratory incubation experiments indicated that suppression of NO3-N formation in pine watershed soils required the presence of live tree roots and was not due to the direct action of allelopathic chemicals on nitrifiers. (Alexander-PTT) W87-00201

FORECASTING POLLUTANT LOADS FROM HIGHWAY RUNOFF, K. D. Kerri, J. A. Racin, and R. B. Howell.

Transportation Research Record, No. 1017, p 39-46, 1985. 10 fig, 2 tab, 12 ref.

Descriptors: *Pollutant loads, *Water pollution sources, *Runoff, California, Urban areas, Rural areas, Monitoring, Rainfall, Boron, Zinc, Lead, Nitrate, Ammonia, Phosphorus, Orthophosphates, Chemical oxygen demand, Mathematical models, Rainfall distribution, Prediction, Regression equa-

Forecasting regression equations were developed for estimating pollutant loads in runoff from high-ways. Data were collected during the runoff sea sons at completely paved urban highway sites in Redondo Beach, Walnut Creek, and Sacramento, California. Information also was obtained from a rural site near Placerville. Urban highways in California that are operated under normal conditions (ie, no accidents or chemical spills) do not produce large amounts of pollutant constituents during storm runoff events. For highway segments that drain between 2 and 4 acres of completely paved areas, and have 6-8 traveled lanes, the constituent pollutant loads in runoff water are sufficiently low so that costly treatment facilities are not needed to so that costly treatment faculties are not needed to meet water quality objectives. Equations to esti-mate the cumulative loads of the following pollu-ants were found to be statistically significant at the 5% level on a storm event basis when correlated with the number of vehicles during the storm and with total residue. (Rochester-PTT)

ASSESSING THE IMPACTS OF OPERATING HIGHWAYS ON AQUATIC ECOSYSTEMS, For primary bibliographic entry see Field 4C.

CONSEQUENTIAL SPECIES OF HEAVY METALS IN HIGHWAY RUNOFF, Y. A. Yousef, H. H. Harper, L. P. Wiseman, and J.

Transportation Research Record, No. 1017, p 56-62, 1985. 3 fig. 5 tab. 10 ref.

Descriptors: *Heavy Metals, *Runoff, *Highways, *Complexation, *Path of pollutants, Toxicity, Florida, Lead, Zinc, Copper, Cadmium, Anodic stripping voltametry, Detention reservoirs, Sediments, Rain, Humic substances.

Species of dissolved heavy metals were identified by using anodic stripping voltametry for rainfall, highway and bridge runoff, and receiving streams at the intersections of Maitland Interchange and Interstate 4 and US-17-92 and Shingle Creek in central Florida. The average dissolved Cd, Zn, Cu, Pb, Ni, Cr, and Fe in the Maitland retention/ detention ponds were 73, 12, 44, 37, 56, 70, and 42% of those detected in the incoming highway runoff, respectively. Similarly, the total Cd, Zn, Cu, Pb, Ni, Cr, and Fe concentrations in the Maitland ponds averaged 53, 2, 27, 3, 8, 34, and 5% of those measured in the incoming highway runoff. Most of the metals in highway runoff appeared to be in particulate form. Bottom sediments in the Maitland ponds have heavy-metal concentrations in the top 5 to 6.8 cm. More than 70% of the soluble Cd and Zn in rainfall, highway runoff, Maitland pond water, and Shingle Creek water exists in ionic form. Most of the Pb exists as PbCO3(o), and a significant fraction of the Cu is associated with organic complexes if humic substances are present. (Rochester-PTT) W87-00209 Species of dissolved heavy metals were identified

COMPARISON OF YIELDS OF SEVERAL CULTIVARS OF FIELD-GROWN SOYBEANS EXPOSED TO SIMULATED ACIDIC RAIN-EXPOSI FALLS,

Brookhaven National Lab., Upton, NY. Dept. of Applied Science. L.S. Evans, K.F. Lewin, E.M. Owen, and K.A.

New Phytologist, Vol. 102, No. 3, p 409-417, March 1986. 4 fig, 3 tab, 15 ref. EFA DW-89930196-01, DOE Contract No. DE-ACO2-76CH00016, Associated Universities, Inc., Contract No. 119899-S.

Descriptors: *Soybeans, *Crop yield, *Acid rain, Simulated rainfall, Hydrogen ion concentration, Seed production, Brookhaven National Laborato-

ry, New York.

The effects of simulated rainfalls of pH 5.6, 4.4, 4.1, and 3.3 on seed yields were determined using four cultivars of field-grown soybeans (Glycine max Merrill). Sixteen plots per treatment were used. Plants were grown using standard agronomic practices under automatically moveable rainfall exclusion shelters, which minimized changes in the plants' microclimate. Soybeans of cv. Amsoy shielded from ambient rainfalls and exposed to simulated rainfalls of pH 4.4, 4.1, and 3.3 exhibited yields that were, respectively, 11.5, 10.4, and 11.7% below those of plants exposed to rain of pH 5.6. The comparable figures for the other cultivars were as follows: Asgrow 3127: 14.5, 12.2, and 9.0%; Corsoy: 13.7, 12.7, and 7.8%; and Hobbit: 9.2, 6.2, and 16.6%. Most of the observed decreases in seed mass per plant and per unit area in these cultivars appeared to have resulted from a corresponding decrease in pod number per plant. (Rochester-PTT) W87-00215

EFFECTS OF ALUMINUM AND LOW PH ON GROWTH AND DEVELOPMENT IN RANA TEMPORARIA TADPOLES,

Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
For primary bibliographic entry see Field 5C.
W87-00219

EFFECTS OF PARAMETER UNCERTAINTY IN STREAM MODELING, Texas Univ. at Dallas, Richardson.

J. J. Warwick, and W.G., Cale. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 3, p 479-489, June 1986. 5 fig, 1 tab, 13 ref. NSF Grant BSR-8211836.

Descriptors: *Hydraulic models, *Monte Carlo simulations, "Parameter uncertainty, "One-dimensional flow, "Steady-state flow, "Uniform flow, Errors, Priority pollutants, Reaction rates, Pollution loading.

Monte Carlo simulation techniques were used to test the effect of input parameter uncertainty on model output uncertainty. The mathematical model selected for investigation was a one-dimensional, steady state, uniform flow expression which includes longitudinal dispersion. Hydraulic input parameters (flow rate, velocity, and longitudinal dispersion) were assumed to be constant with respect to both time and space. Uncertainty in these hydraulic parameters, which results from instream measurement error, was characterized with normal nydraulic parameters, which results from instream measurement error, was characterized with normal distributions. First-order reaction rate uncertainty was assigned a bounded uniform distribution to signify a general knowledge of an expected range for highly reactive and relatively inert organic priority pollutants. In addition, the impact of inadequate pollutant loading characterization was investigated. (Author's abstract) W87-00222

FLOW CHARACTERISTICS OF LANDFILL LEACHATE COLLECTION SYSTEMS AND LINERS,

Stevens Inst. of Tech., Hoboken, NJ. Dept. of Civil Engineering.
G. P. Korfiatis, and A.C. Demetracopoulos.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Sources Of Pollution-Group 5B

Journal of Environmental Engineering (ASCE) JOEED4, Vol. 112, No. 3, p 538-550, June 1986. 10 fig, 1 tab, 11 ref.

Descriptors: *Landfills, *Leachate, *Path of pol-lutants, *Transient liquid balance equations, *Hy-draulic conductivity, Mathematical models, Clay lining, Drainage, Seepage, Slope, Prediction.

The hydraulics of drainage and seepage for a sloping landfill leachate collection system were investigated. A transient liquid balance equation was developed and solved numerically. A dimensionless
form of the model was used to simulate leachate
flow over and through a clay liner. It was found
that the model is very sensitive to changes in the
leachate input rate. The results of the numerical
model were compared to results obtained from a
quasi-steady state model and an analytical solution.
The assumptions made in simplified predictive
models used in design practice are discussed and
their influence is assessed. The model can be used
to predict seepage and drainage rates and head to predict seepage and drainage rates and head build-up on landfill collection systems. (Author's abstract) W87-00223

DO SAG MODEL FOR EXTREMELY FAST RIVER PURIFICATION,
ROOTKEE Univ. (India). Dept. of Civil Engineering.

ROVER FURTHERIAL PROPERTY OF CIVIL Engineering. D.S. Bhargava. Journal of Environmental Engineering (ASCE) JOEED4, Vol 112, no. 3, p 572-585, June 1986. 2 fig, 2 tab, 4 ref, append.

Descriptors: *Streeter-Phelps models, *Dissolved, *Self-purification, *Bioflocculation, *Settleable organic matter, *Biochemical oxygen demand, Rivers, Mathematical models, Oxygen deficit, Oxygen sag, Pollution load.

sical Streeter-Phelps models for co The classical Streeter-Pheips models for computa-tion of the biochemical oxygen demand (BOD) and dissolved oxygen (DO) deficit concentrations in dissolved oxygen (DO) deficit concentrations in streams do not account for biofloculation and sedimentation of the settleable organic matter. The extremely fast BOD assimilation in rivers, based on the physicochemical linear removal of the settleable BOD with exponential laws for the nonsettleable BOD, has been modeled by others. Through the solution of differential equations, models were evolved for the accurate prediction of DO sags after the sewage outfalls drain into streams. Such models account for bioflocculation-sedimentation as well as the biochemical degradation of the nonas well as the biochemical degradation of the non-settleable BOD. Data from the Ganga and Yamuna Rivers (India) were used to evaluate the simple and compound DO sags after the sewage outfells into these rivers. The predicted DO sags agreed fairly well with the observed DO values. (Rochester

GASOLINE RESIDUAL SATURATION IN UN-SATURATED UNIFORM AQUIFER MATERI-

Connecticut Univ., Storrs. Dept. of Civil Engi-

neering.
G.E. Hoag, and M.C. Marley.
Journal of Environmental Engineering (ASCE)
JOEEDU, Vol. 112, No. 3, p 586-604, June 1986. 5
fig, 4 tab, 31 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Groundwater pollution, *Gasoline, Soil saturation capacity, Aquifer characteristics, Particle size, Soil density, Soil water, Sank, Linear regression analysis, Mathematical models.

The importance of the residual saturation capacity The importance of the residual saturation capacity of a soil to gasoline is examined and a rapid, approximate method is proposed for determining the residual saturation capacity of soil to gasoline. Residual saturation capacity of soil to gasoline. Residual saturation capacity was measured experimentally for several soils. Soil particle size, density, and moisture content were varied in the experiments. Sands at field capacity moisture content had lower residual saturation capacities than dry sand. Empirical relationships were developed that predict specific gasoline retention based upon the volume of sand contacted, sand density, particle

diameter, and moisture content. Least squares linear regression analyses indicate correlation coefficients of 0.98 and 0.94 for the empirical relationships developed for dry sand and sand at field capacity moisture content, respectively. Although the sands represent rather ideal soils, the empirical relationships should be useful to those involved in field evaluations of gasoline spills. (Author's abstract) W87-00225

IDENTIFICATION OF ARSENOBETAINE AND ARSENOCHOLINE IN CANADIAN FISH AND SHELLFISH BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH ATOMIC ABSORPTION DETECTION AND CONFIRMATION BY FAST ATOM BOMBARDMENY MASS SPECTOMETRY, Health and Welfare Canada, Ottawa (Ontario). Exoc I Research Div.

Food Research Div. J. F. Lawrence, P. Michalik, G. Tam, and H. B. S.

Journal of Agricultural and Food Chemistry JAFCAU, Vol. 34, 2, p 315-319, March/April 1986. 4 fig, 2 tab, 24 ref.

Descriptors: "Arsenobetaine, "Arsenocholine, "Fish, "Shellfish, "High-performance liquid chromatography, "Canada, "Mass spectrometry, Hadock, Halibut, Cod, Herring, Mackerel, Lobster, Scallops, Shrimp, Pike, Bass, Carp, Pickerel, Whitefish, Yellow Perch, Striped Perch, Salmon, British Columbia, Performance evaluations.

an columbia, Performance evaluations.

The major organic forms of arsenic in fresh marine fish such as haddock, halibut, cod, herring, mackerel, sole, lobster, scallops, and shrimp obtained throughout Canada were identified as arsenobetaine and, in shrimp only, arsenocholine. Freshwater fish including pike, bass, carp, pickerel, whitefish, yellow perch, and striped perch contained assenobetaine or arsenocholine, but did contain methanol-extractable arsenic, which has not yet been identified. Salmon obtained from British Columbia contained arsenobetaine from the reversed-phase high-performance liquid chromatography (HPLC) system employed. The arsenobetaine levels for marine fish ranged from 0.15 to 15.8 microgram/g of fresh weight. Extraction and purification procedures, and confirmation of the compounds by mass spectrometry and derivatization followed by further HPLC characterization are described. (Rochester-PTT)

EFFECT OF GROWTH CONDITIONS AND SURFACE CHARACTERISTICS OF AQUATIC BACTERIA ON THEIR ATTACHMENT TO

Warwick Univ., Coventry (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2H.

CHANGING ROLE OF NATURAL AND AN-THROPOGENIC PROCESSES IN THE DEVEL-OPMENT OF EUTROPHICATION OF CONTI-NENTAL WATERS, Akademiya Nauk SSSR, Leningrad. Inst. Ozerove

uemya. 1. S. Koplan-Diks, and V.L. Alekseev. Soviet Journal of Ecology SIECAH, Vol. 16, No. 5, p 269-272, May 1986. 1 tab, 24 ref. Translated from Ekologiya, No. 5, p 20-23, September-Octo-

Descriptors: *Phosphorus, *Eutrophication, *Anthropogenic processes, *Surface water, *Biogeochemical cycle, *Cycling nutrients, Ecosystems, Forecasting, Technological change, Economic

The introduction of phosphorus into the water bodies of the world was calculated for 1900, 1940, and 1980 in terms of total P flow into the water in million tons P/yr, and the ratio of natural to anthropogenic inputs of P was determined. The figures for these years are respectively, 5.5 and 2.7 (ratio 2:1), and 2.7 (ratio 2:1),

and 2.9 and 10.9 (ratio 1:4). Since anthropogenic inputs dominate the process of eutrophication at present, and their role will continue to grow, the authors state that success of forecasting the state of natural waters will be determined primarily by understanding the future development of the economy and, particularly, technology in sectors producing biogenic matter. (Rochester-PTT) W87-00237

PROGRESS IN THE RADIOECOLOGICAL STUDY OF SEVERAL ECOSYSTEMS NEAR THE BELOYARSKII NUCLEAR POWER

Akademiya Nauk SSSR, Sverdlovsk. Inst. of Plant and Animal Ecology. I. V. Molchanova, E. N. Karsvaeva, and N. V.

Soviet Journal of Ecology SJECAH, Vol. 16, No. 5, p 278-282, May 1986. 5 tab, 8 ref. Translated from Ekologiya, No. 5, p 30-34, September-October 1985.

Descriptors: *Radioecology, *Bogs, *Rivers, *Nuclear powerplants, *Strontium-90, *Cesium-137, *Beloyarskii Nuclear Power Plant, Soviet Union, Bog soils, Pollutants, Radioisotopes.

A radioecological study was conducted of a portion of the bog-river ecosystem situated 5 km to the southeast of the Beloyarskii nuclear power plant (Sverdlovsk Region, USSR) and of control sites located outside the range of powerplant influence. The content of Sr90 and Cs137 in the water fluctuated about average values one-two orders of magnitude lower than the maximum permissible concentrations for potable water. Some increase in the radionuclide content was demonstrated in the bottom of the bog and in bogside soils, where they are practically isolated from the soil-plant cover of the adjacent biogeocenoses. (Author's abstract) W87-00238

GROUNDWATER QUALITY TODAY AND TO-

MORROW, Milioeministeriet, Copenhagen (Denmark). World Health Statistics Quarterly, Vol. 39, No. 1, 81-92, 1986. 6 fig, 4 tab, 8 ref.

Descriptors: *Groundwater pollution, *Denmark, *Acidification, *Pesticides, *Nitrates, Necessary reduction fraction, Drinking water, Management planning, Agriculture, Fertilizers.

Factors affecting groundwater quality in Denmark are discussed under the following headings: health implications of groundwater pollution (nitrate, acidification, and pesticides), pollution load on the ground (nitrate load and pesticide load), relationship between soil load and concentration of pollutants in groundwater (necessary reduction factor (NRF) in nitrogen fertilizer and NRF for pesticides), investigation of groundwater quality intrate content in groundwater and drinking water, trends in nitrate concentrations in drinking-water supply plants, private wells, and pesticides in drinking water. Although the quality of groundwaters in Denmark today is acceptable, trends toward unacceptable concentration levels of pollutants are evident. Measures to avert the threat of pollution by ever-increasing use of fertilizers and pesticides must be implemented now, before it is too late. (Rochester-PIT)

EFFECT OF NITRATE ON BIOGENIC SUL-FIDE PRODUCTION, Oklahoma Univ., Norman. Dept. of Botany and Microbiology. For primary bibliographic entry see Field 5C. W87-00255

ISOLATION OF NON-O1 VIBRIO CHOLERAE SEROVARS FROM SURFACE WATERS IN WESTERN COLORADO, Colorado State Univ., Grand Junction. Fruita Re-

search Center.

Group 5B-Sources Of Pollution

For primary bibliographic entry see Field 5A. W87-00256

STIMULATION OF METHANOGENESIS BY ALDICARB AND SEVERAL OTHER N-METHYL CARBAMATE PESTICIDES, State Univ. of New York at Stony Brook. Marine res Research Center

R. P. Kiene, and D.G. Capone. Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 6, p 1247-1251, June 1986. 4 fig. 1 tab. 26 ref. Hudson River Foundation Grant 14-83B-12, EPA Grant R-809475-01-0, NOAA Grant NA-80-RAD-0057.

Descriptors: *Water pollution effects, *Resticides, *Aldicarb, *Methomyl, *Carbaryl, *Baygon, *Monomethylamine, *Hydrolysis, *Marsh soils, *Methanogenesis, Bacterial physiology, Aquifers.

Methanogenesis, Bacterial physiology, Aquifers. Aldicarb and several other N-methyl carbamate pesticides stimulated methane production in anaerobic salt marsh soils and organic-rich aquifer soils. Stimulation was biological and linearly related to the amount of carbamate added. Of the four carbamates studied, methomyl gave the greatest stimulation followed by carbaryl, aldicarb, and baygon. The percent conversions ((moles of CH4 in excess of control/mole of carbamate added) x 100) for methomyl, carbaryl, aldicarb, and baygon were 88, 57, 40, and 11, respectively. Using aldicarb as a model carbamate, we found that monomethylamine (MA) accumulated in sediments as a result of aldicarb addition. MA arises from the N-methyl carbamoyl portion of the carbamates as a result of presumptive biological hydrolysis. MA levels decreased as CH4 production was stimulated, and 2-bromoethane sulfonic acid (a specific inhibitor of methanogenesis) partially inhibited the loss of MA. These findings suggest that N-methyl carbamates are readily hydrolyzed to MA in the presence of an active microbial population under anaerobic conditions and that methanogenesis is stimulated as a result of the consumption of MA by methanogenic bacteria. (Author's abstract)

INFLUENCE OF SAHARAN DUST ON THE RAIN ACIDITY AND ATMOSPHERIC INPUT TO THE MEDITERRANEAN,

Institut de Biogeochimie Marine, Paris (France). M.D. Loye-Pilot, J.M. Martin, and J. Morelli. Nature, Vol. 321, No. 6068, p 427-428, 22 May Nature, Vol. 321 1986. 2 fig, 36 ref.

Descriptors: *Corsica, *Dust storms, *Red rain, *Red snow, *Sahara, *Aerosols, *Mediterranean, *Acid rain, *Calcium carbonate, Hydrogen ion

From 1984 data on the chemistry of precipitation, obtained near the Bavella Pass in South Corsica, the authors show that, due to its CaCO3 content, Saharan dust significantly increases the pH of rain. This may counteract the effects of acid rain. African dust deposition may account for an input of 3,900,000 tons annually, an amount which is of the same order of magnitude as the annual downstream same order of magnitude as the annual downstream flow of solids in the (Rhone River 4,300,000 tons). Thus, atmospheric input to the northwestern Medi-terranean contributes significantly to sedimentation in that region. (Rochester-PTT) W87-00259

ENTRAINMENT-BASED FLUX OF PHOSPHO-RUS IN ONONDAGE LAKE, Upstate Frestwater Inst., Inc., Syracuse, NY. S.W. Effler, M.C. Wodka, C.T. Driscoll, C. Brooks, and M. Perkins. Journal of Environmental Engineering JOEED4, Vol. 112, No. 3, p 617-622, June 1986. 3 fig. 16 ref.

Descriptors: *Onondaga Lake, *Lake sediments, *Phosphorus, *Metaliminion, *Water circulation, Mathematical models, Pollution loads, New York,

The amount of phosphorus recycled to the upper layers of Onondaga Lake (New York) from the enriched metalimnion by entrainment-based trans-

port were estimated, for the spring-to-fall intervals of 1980 and 1981. The entrainment-based phosphor-rus loading was compared to the attendant diffusi-vity-based internal phosphorus loading and the ex-ternal (total and dissolved) loading. The internal loading of phosphorus due to entrainment was vis-based internal phosphorus loading and the external (total and dissolved) loading. The internal loading of phosphorus due to entrainment was approximately 20% greater than that associated with diffusivity through late June. It represented approximately 40% of the internal load due to vertical mixing processes and 12% of the external load, for the May-through-October interval. During May and June the entrainment-based internal load was approximately 30% of the external load. The summed internal loading from these two mixing processes was significant by comparison to external loads. It represented approximately 33% of the external dissolved phosphorus loading, a 28% of the total external phosphorus loading, for the May-through-October interval. The magnitude of the entrainment-based flux of phosphorus in the lake dictates that it be incorporated in any mechanistic seasonal phosphorus model for the lake. (Rochester-PTT)

INVESTIGATION OF CHOLERA ACQUIRED FROM THE RIVERINE ENVIRONMENT IN QUEENSLAND,

QUEENSLAND, Queesland Dept. of Health, Brisbane (Australia). A.T.C. Bourke, Y.N. Cossins, B.R.W. Gray, T.J. Lunney, and N.A. Roston. The Medical Journal of Australia, Vol. 144, p 229-234, March 3, 1986. 1 fig, 3 tab, 40 ref.

Descriptors: *Cholera, *Queensland, *Rivers, Microbial analysis, Epidemiology, Australia.

Since February 1977, five patients with cholera apparently acquired the infection from the riverine environment in Queensland. A total of 13 rivers have now yielded at least one isolate of Vibrio cholerae 01 biovar El Tor. Investigations indicate cholerae Ol biovar El Tor. Investigations indicate that the organism, including toxigenic strains, can survive and multiply in the riverine environment. No human or animal reservoirs and no ecological niches were identified and no route of importation or dissemination of the organism was discovered. The microbiological examination of feces in all medical inboratories in Australia should include the organism was discovered. methods for detecting the cholera organism as a routine. When confronted with a cholera infection, medical practitioners should obtain a history of recent travel, both in Australia and overseas. (Author's abstract) W87-00273

STUDIES ON MICROBIAL QUALITY OF FILTERED WATER IN HOUSEHOLDS OF A UNIVERSITY COMMUNITY IN NIGERIA, Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Veterinary Surgery.
For primary bibliographic entry see Field 5F.
W87-00275

PALEOEPIDEMIOLOGIC INVESTIGATION
OF LEGIONNAIRES DISEASE AT WADSWORTH VETERANS ADMINISTRATION
HOSPITAL BY USING THREE TYPING
METHODS FOR COMPARISON OF LEGIONELLAE FROM CLINICAL AND ENVIRONMENTAL SOURCES,
Veterans Administration Wadsworth Medical
Center, Los Angeles, CA.
For primary bibliographic entry see Field 5A.
W87-00276

ANNUAL CYCLE OF GASEOUS SULFUR EMISSIONS FROM A NEW ENGLAND SPAR-TINA ALTERNIFLORA MARSH, Marine Biological Lab., Woods Hole, MA. Eco-systems Center. For primary bibliographic entry see Field 5A. W87-00281

ANALYSIS OF THE SULFUR BUDGET AND INTERSTATE SULFUR TRANSPORT FOR COLORADO, Environmental Defense Fund, Washington, DC.

M. Oppenheimer. Atmospheric Enviroment ATENBP, Vol.19, No.9, p 1439-1443, September 1985. 2 tab, 25 ref.

Descriptors: *Acid rain, *Acid precipitation, *Sulfur dioxide, *Sulfates, *Path of pollutants, *Long-range transport, *Colorado, Air pollution, Fallout, Rainfall.

The sulfur budget for Colorado was analyzed in order to understand the importance of interstate transport and natural sources to wet sulfur deposition in the state. A climatological box model was used to separate the various contributions to sulfur used to separate the various contributions to sulfur deposition. They demonstrated that sulfur dioxide molecules emitted in Colorado have a low probability of wet sulfur deposition in Colorado. As much as 80% or more of the wet sulfur deposition in the state must be ascribed to external anthropogenic sulfur sources, such as non-ferrous metal smelters and electric powerplants unless some large unspecified natural sulfur source exists. Long range transportation of sulfur has made a substantial contribution to acid deposition in Colorado and probably other parts of the West as well. Substantial non-ferrous metal smelter sources outside Colorado also play a primary role in interstate pollutant transportation. (Khumbatta-PTT)

CHEMICAL DIFFERENCES BETWEEN EVENT AND WEEKLY PRECIPITATION SAM-PLES IN NORTHEASTERN ILLINOIS, Argonne National Lab., IL. Environm

D. L. Sisterson, B. E. Wurfel, and B. M. Lesht. Atmospheric Environment ATENBP, Vol.19, No.9, p 1453-1469, September 1985. 6 fig. 8 tab, 41

Descriptors: *Acid rain, *Acid precipitation, *Precipitation chemistry, Precipitation integrity, Weekly precipitation, Rainfall, Intercomparison, Illinois, Event precipitation, Precipitation.

Samples collected from event and weekly precipitation in Northeastern Illinois from April 1980 to March 1982, were examined for chemical differences. Analysis were conducted for H(+), Ca(2+), Mg(2+), NH4(+), S04(2-), and NO3(-) concentrations as well as for pH and conductivity. Although seasonal and annual precipitation amounts were different for the two years, the general pattern of event and weekly samples had significantly less NH4(+) and higher laboratory pH in all seasons and more SO4(2-) in every season but summer. Weekly samples had significantly less NH4(+) and higher laboratory pH in all seasons and more SO4(2-) in every season but summer. Weekly samples had significantly more Ca(2+) and Mg(2+) during seasons with little precipitation. Event and weekly NO3(-) were never significantly different. The weekly samples had more total acidity in the spring but less in the summer. The observed differences were attributed to chemical degradation of the weekly samples while awaiting collection and during shipment between the field and the laboratory. (Khumbatta-PTT) PIT W87-00283

SCAVENGING RATIOS OF ACIDIC POLLUT-ANTS AND THEIR USE IN LONG-RANGE TRANSPORT MODELS, Ontario Ministry of the Environment, Toronto. Air Resources Branch. P. K. Misra, W. H. Chan, D. Chung, and A. J. S.

Atmospheric Environment ATENBP, Vol. 19, No. 9, p 1471-1475, September 1985. 6 tab, 11 ref.

Descriptors: *Acid rain, *Scavenging ratios, *Acidic pollutants, *Atmospheric contamination, Log-normal distribution, Long-range transport models, Pollutants, Sulfur ions, Nitrogen ions.

The scavenging ratios for SO2, SO4(2-), and NO3(-) vary markedly between precipitation events and were shown to possess log-normal distributions. Using a constant value of scavenging ratio as an input parameter into a model will lead to significant errors in model calculations. Scav-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Sources Of Pollution-Group 5B

enging ratios for SO4(2-) showed little spatial variation. The spatial variability for NO3(-) was larger. Also the scavenging ratios for NO3(-) suggested that in-cloud formation, NO3(-) may be important. Using an average value of the scavenging ratio in linear long-range transport models may lead to serious errors in model predictions at remote areas. The use of a variable scavenging ratio based on the distribution presented in the paper was recommended. (Khumbatta-PTT) W87-00284

TRACE ORGANIC COMPOUNDS IN RAIN - II.
GAS SCAVENGING OF NEUTRAL ORGANIC
COMPOUNDS,
Oregon Graduate Center, Beaverton. Dept. of
Chemical, Biological, and Environmental Sciences.
M. P. Ligocki, C. Leuenberger, and J. F. Pankow.
Atmospheric Environment ATENBP, Vol. 19, No.
10,p 1609-1617, October 1985. 4 tab, 18 ref. U.S.
EPA Grant No. R8113380.

Descriptors: *Air pollution, *Gas scavenging, *Oregon, *Precipitation scavenging, *Trace Compounds, Henry's Law, Organic compounds, Aromatic hydrocarbons, Pollutants, Rainfall.

matic hydrocarbons, Pollutants, Rainfall.

Concurrent rain and air sampling was conducted for seven rain events in Portland, Oregon during February through to April of 1984. Concentration data were presented for a number of neutral organic compounds. The ambient temperature averaged 8 C. Measured gas scavenging ratios (w sub g) ranged from 3 for tetrachloroethene to 100000 for dibutylphthalate, and were generally 3 to 6 times higher than those calculated from Henry's Law constant (H) taken at 25 C from the literature. The discrepancy was due to the incorrectness of applying 25 C data at 5-10 C. The data presented there for several PAHs demonstrated very good agreement between measured gas scavenging ratios of trace neutral organic pollutants and those predicted based on laboratory P and S determinations at the same temperature. Equilibrium was attained between falling raindrops and the atmospheric gas phase for these non-reactive organic compounds. W sub g values obtained here can be used to provide estimates of H at approximately 8 C for the compounds for which temperature-dependent H data were not available. (See also W87-00286) (Khumbatta-PTT)

TRACE ORGANIC COMPOUNDS IN RAIN -III. PARTICLE SCAVENGING OF NEUTRAL

III. PARTICLE SCAVENGING OF NEUTRAL ORGANIC COMPOUNDS, Oregon Graduate Center, Beaverton. Dept. of Chemical, Biological, and Environmental Sciences. M.P. Ligocki, C. Leuenberger, and J. F. Pankow. Atmospheric Environment ATENBP, Vol.19, No.10, p 1619-1626, October 1985. 1 fig, 4 tab, 21 ref. U.S. EPA Grant No.R8113380.

Descriptors: *Air pollution, *Precipitation scavenging, *Particle scavenging, *Scavenging, *Pollution, *Atmospheric pollution, Scavenging ratios, Organic compounds. Organic com

Concurrent measurements were obtained for a number of neutral organic compounds associated with suspended particles in rain and in the atmosphere. Particle scavenging ratios (W sub p) were determined and compared to gas scavenging ratios (W sub g) obtained concurrently, to determine the relative importance of particle vs gas scavenging for organic compounds. The measured W sub p values were much higher for polycyclic aromatic hydrocarbons (PAHs) of molecular weight < or = 202, alkanes and phthalate esters. The W sub p values ranged from 100 to 100000 and averaged 14,000. The low scavenging ratios are consistent with a below-cloud process for the particles containing these organic compounds. The compounds with relatively higher W sub p values may be associated to a larger extent with large particles which are more efficiently scavenged below-cloud. Due to the low W sub p values found for most of the PAHs, particle scavenging was less important than gas scavenging for those compounds. (See also W87-00285) (Khumbatta-PTT) W87-00286

PERSONAL EXPOSURES, INDOOR-OUT-DOOR RELATIONSHIPS, AND BREATH LEVELS OF TOXIC AIR POLLUTANTS MEAS-URED FOR 355 PERSONS IN NEW JERSEY, ental Protection Agency, Research Tri-

angle Park, NC.
L. A. Wallace, E.D. Pellizzari, T. D. Hartwell, C.
M. Sparacino, and L. S. Sheldon.
Atmospheric Environment ATENBP, Vol. 19, No.
10, p 1651-1661, October 1985. 1 fig, 12 tab, 28 ref.

Descriptors: *Indoor-outdoor relationships, *Drinking water, *Path of pollutants, *Air pollution, *New Jersey, Toxics, Occupational exposure, Organic emissions, TEAM.

EPA's TEAM Study had measured exposures to 20 volatile organic compounds in personal air, outdoor air, drinking water and the breath of 355 persons in NJ, in the fall of 1981. The residents were selected by a probability sampling scheme to represent 128000 inhabitants of Elizabeth and Battaliant in the compound residents. were selected by a probability sampling scheme to represent 128000 inhabitants of Elizabeth and Bayonne. Participants carried a personal monitor to collect two 12-h air samples and gave a breath sample at the end of the day. About 3000 samples were collected out of which 1000 were quality control. Eleven compounds were often present in air. Personal exposures were consistently higher than outdoor concentrations for these chemicals, and were sometimes ten times the outdoor concentrations. Breath concentrations as usually exceeded outdoor concentrations, and correlated more strongly with personal exposures than with outdoor concentrations. Some activities and exposures were associated with significantly more elevated exposures and breath levels for certain toxic chemicals. Drinking water was the main source for two trihalomethanes: chloroform and bromodichloromethane. The weighted arithmetic mean intake of chloroform was 70 micrograms through water and 90 micrograms through water and 90 micrograms through water susually supplied less than 1% of the total daily intake. (Khumbatta-PTT)

PRECIPITATION CHEMISTRY AFFECTED BY DIFFERENCES IN LOCATION OF COLLECTION SITES AND STORAGE METHODS, Maritimes Forest Research Centre, Fredericton (New Brunswick). For primary bibliographic entry see Field 2B. W87-00288

EMISSIONS OF BIOGENIC SULFUR GASES FROM A DANISH ESTUARY,
Aarhus Univ. (Denmark). Inst. of Ecology and

B. B. Jorgensen, and B. Okholm-Hansen. Atmospheric Environment ATENBP, Vol 19, No. 11, p 1737-1749, November 1985. 9 fig, 2 tab, 46 ref. EEC Environmental Program Contract No. ENV-588-DK.

Descriptors: *Norsminde Fjord, *Sulfur gases, *Estuaries, *Denmark, Air pollution, Water pollution, Seawater, Diurnal distribution, Shallow waters, Flux chambers.

waters, Flux chambers.

Diurnal variations in sulfur emissions were studied at seven sites in a Danish estuary, Norsminde Fjord. The sites comprised grass vegetation, intertidal mud flats, accretions of green algae, an exposed shore and a river outlet. Direct measurements of emission rates from soil and water were done by a dynamic flux chamber technique in connection with gas chromatographic detection and separation of the cryogenically trapped sulfur gases. Sulfur gas concentrations in air and seawater were measured together with emission rates at 0.5-1 hour intervals over 25-40 hp reprods. DMS was the most important sulfur gas released from grass and algae while mostly H2S was released from intertidal mud flats. DMS emission followed the daylight variations often with a delay towards maximum emission rates in the evening. H2S was mostly emitted at night or in short bursts during low tides. Total sulfur emission rates were 1-10 micromol \$f\$ yf\$ m/d. Extreme rates were measured over decomposing green algae (Ulva lactuca). H2S was detected along with other pollutants in the

oxic seawater of the estuary at diurnal mean con-centrations of 0.1-6.5 nanomol S/L. This may indi-cate a more widespread occurrence of H2S in shallow, near-shore waters at nanomolar levels. (Author's abstract)

SOURCE APPORTIONMENT OF WET SUL-FATE DEPOSITION IN EASTERN NORTH AMERICA,

Massachusetts Inst. of Tech., Cambridge. Energy

J. A. Fay, D. Golomb, and S. Kumar. Atmospheric Environment ATENBP, Vol.19, No.11, p 1773-1782, November 1985. 7 fig. 2 tab, 24 ref.

Descriptors: *Acid rain, *Air pollution, *Acid de-positon, *Sulfate precipitation, *Atmospheric sulfur budget, *Sulfur transport, *Emission control policy, *Atmospheric pollution, Eulerian models, Eastern North America.

Eastern North America.

An analytical model of long distance transport of air pollutants was adapted for the estimation of long term wet sulfate deposition in eastern N. America. The model parameters were optimized for best agreement with 1980-1982 measurements at 109 monitoring sites in that region. The root mean square residual of the model and measurement comparison is 4 kg/ha/y (17% of the mean measured value). Transfer coefficients were found to decrease exponentially with source-receptor distance, having length scales between 1100 and 400 km depending upon whether the source was upwind or downwind of the receptor. Source apportionment calculated for four sites from this model showed that about half of the deposition is due to 7-8 of the largest source contributors to each site. A 17 year record of precipitation sulfate measured at Hubbard Brook, New Hampshire compared favorably with the model calculation. Calculated U.S.-Canda transboundary fluxes differ from previous estimates. Isopleths of 1980-22 yearly depositions were determined. A proposed 45% reduction in U.S. sulfur emissions was found to produce about a 35% reduction of deposition at environmentally sensitive areas in the U.S. and Canada. (Author's abstract) W87-00290

CHEMICAL COMPOSITION OF CLOUD AND RAINWATER. RESULTS OF PRELIMINARY MEASUREMENTS FROM AN AIRCRAFT, Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands). Environmental Dept. For primary bibliographic entry see Field 5A. W87-00291

BIOGENIC AND ANTHROPOGENIC ORGAN-IC COMPOUNDS IN RAIN AND SNOW SAM-PLES COLLECTED IN SOUTHERN CALIFOR-

NIA, California Univ., Los Angeles. Inst. of Geophysics

Cantornas Univ., Los Angetes. Inst. of Geophysics and Planetary Physics. K. Kawamura, and I.R. Kaplan. Atmospheric Environment ATENBP, Vol. 20, No. 1, p 115-124, January 1986. 5 fig. 5 tab, 20 ref. EPA Grant No. CR-807864-02-0.

Descriptors: *Air pollution, *Organic compounds, *Rain, *Snow, *Biogenic organic compounds, *Anthropogenic organic compounds, *California, *Acid rain, Organic wastes, Hydrocarbons, Rain

Ten rainwater and snow samples were collected from the Los Angeles area and its vicinity in Southern California. Studies were conducted for various types of solvent-extractable organic compounds, including n-alkanes, UCM hydrocarbons, PAHs, FAs, benzoic acids and phenols. In rural snow samples, the major identifiable species were odd-carbon-numbered n-alkanes in the C17-C35 range and even-carbon-numbered FAs in the C12-C30 range, which were both of biogenic origin. Los Angeles urban rain samples contained abundant phenols, benzoic acids and UCM which were considered to originate from the incomplete com-

Group 5B—Sources Of Pollution

bustion of fossil fuels mostly from automobiles. The results indicated that in urban areas, anthropogenic sources are the most important factors controlling the organic chemistry of rainwater, whereas biogenic sources are a minor contributor. (Khumbatta-PTT) W87-00295

SECOND GENERATION MODEL FOR RE-GIONAL-SCALE TRANSPORT/CHEMISTRY/

GIONAL-SCALE TRANSPORT/CHEMISTRY/ DEPOSITION, lowa Univ., lowa City. Dept. of Chemical and Materials Engineering. G.R. Carmichael, L. K. Peters, and T. Kitada. Atmospheric Environment ATENBP, Vol. 20, No. 1, p 173-188, January 1986. 11 fig, 3 tab, 40 ref. NASA Grant No. NAG 1-36.

Descriptors: *Acid rain, *Model studies, *Regional modeling, *Acid deposition, Eulerian models, *Finite element method, Mathematical studies, Air pollution, Transportation, Chemistry, Deposition.

pollution, Transportation, Chemistry, Deposition. The regional-scale transport, chemistry and deposition of acidifying compounds, photochemical oxidants and their precursors were analyzed using a second-generation Eulerian model. The important atmospheric processes were incorporated using chemical, dynamical and thermodynamical parameterizations having sufficient detail to accomodate boundary layer-free troposphere exchange in cloudy and cloud-free environments, and in-cloud and below-cloud wet removal and chemistry. Forty-one species were considered, many of which were also present in the liquid-drop phases. In the regional scale transport, the advected species were NO, NO2, SO2, SO4(2-), O3, HNO3, NH3, PAN, H2O2, HCHO, alkanes, C2H4, other olefins, aromatica, RCHO, ROOH, HNO2, RONO2 and RO2NO2. The model capabilities were proved by showing simulations in which non-precipitating clouds were present to absorb gas-phase species, chemically alter these, and then release them to the atmosphere. (Author's abstract)

MEASUREMENT OF NTTROUS OXIDE RE-DUCTASE ACTIVITY IN AQUATIC SEDI-

Geological sources Div. cal Survey, Menlo Park, CA. Water Re-For primary bibliographic entry see Field 5A. W87-00302

METHODS FOR MEASURING SPECIFIC RATES OF MERCURY METHYLATION AND DEGRADATION AND THEIR USE IN DETER-MINING FACTORS CONTROLLING NET RATES OF MERCURY METHYLATION, Assets North Associates Wissings (Maritch) Agassiz North Associates, Winnipeg (Manit For primary bibliographic entry see Field 5A. W87-00303

ISOLATION OF NON-01 VIBRIO CHOLERAE SEROVARS FROM OREGON COASTAL ENVI-

Oregon State Univ., Corvallis. Dept. of Microbiology.

ology. D. L. Tison, M. Nishibuchi, R. J. Seidler, and R. J.

Siebeling.

Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 2, p 444-445, February
1986. 1 tab, 11 ref. NOAA grant NA 79AAD00106, project R/FSD8.

Descriptors: *Oregon, *Bacteria, *Human diseases, Pathogen, Sediments, Shellfish, Estuaries.

There has been heightened interest in the occur-rence of potentially pathogenic Vibrio species in U.S. coastal environments since the 1978 outbreak of 11 cases of V. cholerae 01 in Louisiana. Water, sodiment, and shellfish from three Oregon estuaries were cultured for pathogenic Vibrio species. Non-01 serovars of V. cholerae were the most common pathogenic Vibrio species recovered. Non-01 V. cholerae were isolated from all three estuaries sam-neled, covering an area of about 170 miles slowe the pled, covering an area of about 170 miles along the Oregon coast. Non-01 V. cholerae were isolated

from water and sediment, but not shellfish, at temperatures ranging from 11 to 19 C and salinities of 0.23 to 2.6%. Sixteen isolates representing 12 different non-01 serovars were identified, while four non-01 V. cholerae isolates failed to react with any of the 54 antisera tested. These results indicate that non-01 V. cholerae serovars can be found over a large geographic area and under a found over a large geographic area and under a variety of environmental conditions. These organisms are apparently an autochthonous component of these estuarine microbial communities. (Main-PTT) W87-00306

LONGITUDINAL DISPERSION IN SHIP-

CANALS, Vrije Univ., Brussels (Belgium). Lab. of Hydrolo-

gy. J. L. Marivoet, and W. van Craenenbroeck. Journal of Hydraulic Research, Vol. 24, No. 2, p 123-132, 1986. 11 fig, 3 tab, 10 ref.

Descriptors: *Wastewater pollution, *Path of pollutants, *Canals, *Tracers, *Navigation canals, Waterways, Dispersion, Longitudinal Dispersion,

Longitudinal dispersion coefficients in ship-canals in Northern Belgium were measured by iodide tracer experiments to determine the longitudinal dispersion coefficient for accidental wastewater discharges. A formula, proposed by Fischer, for estimating the longitudinal dispersion coefficients in rivers allows explanation of the observed dispersion coefficient by reducing the constant alpha from 0.011 to 0.0021. The smaller value can be justified theoretically. This formula can also be used for canals in which an unsteady flow takes place by considering only the continuous fractions of the flow to estimate the velocity. (Master-PTT) W87-00326

RELATIONSHIPS BETWEEN PRECIPITA-TION CHEMISTRY AND SOME METEORO-LOGICAL PARAMETERS IN THE NETHER-LANDS: A STATISTICAL EVALUATION, LANDS: A STATISTICAL EVALUATION, Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science. J. J. H. M. Duysings, J. M. Verstraten, L. Bruijnzeel, and W. Bouten. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 213-223, April 1986. 1 fig, 4 tab, 35 ref.

Descriptors: *Air pollution, *Path of pollutants, *Precipitation, *Chemistry of precipitation, *Acid rain, *Meteorological data collection, Netherlands, Bulk precipitation, Rainfall.

Bulk precipitation was sampled every 2 weeks for more than 2 years in a lowland catchment in the eastern part of the Netherlands and dissolved constituents were determined. Concentrations of the situents were determined. Concentrations of the main constituents: SO4, NH4, Cl, NO3, Na, Ca, H, Mg, and K are tabulated. Specific source regions for these ion species were determined. Despite the complex character of precipitation chemistry and the rather long sampling interval, statistical evaluation of the data provided discriminating results. Four sources could be distinguished: easspray supplying major part of Na, Mg, and Cl; industrial activities (Ruhr area) contributing excess amounts of Cl and SO4 in association with NH4; rural activities supplying NO3, while K, Ca and excess amounts of Na and Mg mainly derive from local dust. No clear source area could be detected for H, but it was shown that SO2-emission is the main source of acidification. (Author's abstract) W87-00328

VARIATION IN TRACE METAL EXPORTS FROM SMALL CANADIAN SHIELD WATER-FROM SHEDS, Univ.,

Peterborough (Ontario). Trent tic Research Centre. Water, Air, and Soil Pollution WAPLAC, Vol.28, No. 3/4, p 225-237, April 1986. 2 fig, 5 tab, 31 ref.

Descriptors: *Trace metals, *Path of pollutants, Watersheds, *Lakes, Ecosystems, Ecology,

Metals, Copper, Lead, Cadmium, Muskoka, Ontar-io, Streams, Seasonal variation, Snowmelt, Quanti-tative analysis, Forest watersheds.

Annual exports of Cu, Pb, and Cd were estimated for eleven headwater and two lake outflow streams in the District of Muskoka, Ontario, Canada. CoCl2-APDC coprecipitation coupled with anodic stripping voltametry was used to determine metal concentrations. Concentrations of all three metals were similar to those reported from other temperate forested ecosystems, being usually <1 microgram/L with Cd undetectable (<25 nanogram/L) in many samples. There was limited evidence for a spring peak in metal concentrations associated with the snowpack melt. Annual export (mass per unit area per year) of each metal was calculated; variability between streams was small. Exports of Pb appear to be related to the organic content of the water. Copper export was correlated with watershed area, not with organic acids, implying that a different transport mechanism and possibly a different source are important for this metal. The exports of Pb and Cu were much lower in all streams than the estimated annual atmospheric metal depositions reported for this area. Terrestrial retention was higher than 95% for all catchments, while lake retention was slightly lower in some cases. Terrestrial inputs can comprise a significant portion of the total metal load to typical lakes in this region because of the size of the catchments relative to lake areas. (Author's abstract) stract) W87-00329

EFFECIS OF AN ACID PRECIPITATION EVENT ON THE NEAR-SURFACE WATER CHEMISTRY OF AN OLIGOTROPHIC LAKE, Clemson Univ., SC. Dept. of Environmental Systems Engineering. For primary bibliographic entry see Field 5C. W87-00330

TRACE ORGANICS IN SEPTIC TANK EFFLU-

Regina Univ. (Saskatchewan). Faculty of Engi-

T. Viraraghavan, and S. Hashem. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 299-308, April 1986. 8 tab, 12 ref.

Descriptors: *Effluents, *Primary pollutants, *Wastewater lagoons, *Septic tanks, *Organic compounds, Trace levels, Chloroform, Bromodichloromethane, Toluene, Benzene, Methylene, Chloride, Tetrachloroethylene, Wastewater treat-

ment, Regina, Canada.

The presence and level of certain trace organics were estimated in wastewater samples collected from a septic tank in an individual household, from a lift station, and from a waste treatment lagoon near Regina, Canada. Out of 11 priority pollutants analyzed, 6 (chloroform, bromodichloromethane, toluene, benzene, methylene chloride and tetrachlorocthylene) were detected in the samples. Benzene and bromodichloromethane were dominant. Methylene chloride and tetrachlorocthylene could not be quantified at the low concentrations present. Chloroform was present in the lagoon effluent sample once at a concentration of 0.03 microgram/L. Toluene was not present either in the septic tank effluent or in the lagoon effluent. Benzene was present in the septic tank effluent (max. value 450 microgram/L) and in the lagoon effuent max. value 420 microgram/L) and in the lagoon effuent and lagoon effluent at these comparatively low concentrations. These low levels of organics may not pose any significant risk either to aquatic life or to public health, taking into account the attentuation capacity of the soil and the dilution usually available. (Author's abstract) W87-00333

EFFECT OF THE QUANTITY AND DURA-TION OF APPLICATION OF SIMULATED ACID PRECIPITATION ON NITROGEN MIN-

Sources Of Pollution-Group 5B

ERALIZATION AND NITRIFICATION IN A

FOREST SOIL,
Cornell Univ. Agricultural Experiment Station,
Ithaca, NY. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W87-00334

COPPER SPECIES IN AQUEOUS SEWAGE

COPPER SPECIES IN AQUEOUS SEWAGE SLUDGE EXTRACT, Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water. For primary bibliographic entry see Field 5D. W87-00337

MICROBIAL CONTAMINATION OF ALLUVI-AL GRAVEL AQUIPERS BY SEPTIC TANK EF-FLUENT, Ministry of Works and Development, Christ-church (New Zealand). Water and Soil Div. L. W. Sinton. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 407-425, April 1986. 8 fig, 2 tab, 26 ref.

Descriptors: *Groundwater pollution, *Contamination, *Path of pollutants, *Septic tanks, *Effluents, *Aquifers, Groundwater, Alluvial aquifers, New Zealand, Christ Church, Bacteria, Confined aquifers, Diurnal distribution.

The effects of two methods of septic tank effluent disposal on the microbial quality of alluvial gravel aquifers were investigated at an experimental site in the Canterbury Plains, New Zealand. The movement of fecal coliform bacteria 9m from a in the Canterbury Plains, New Zealand. The movement of fecal coliform bacteria 9m from a 5.5m deep soakage pit into an unconfined aquifer, and 42m from an 18m deep injection bore into a confined aquifer was recorded. Partial sealing of the soakage pit sidewalls was evident, but approximately 80% of the effluent appeared to percolate rapidly into the unconfined groundwater through a permeable pathway in the unsaturated zone. Evidence of groundwater mounding beneath the soakage pit was found and a consequent radial spread of leachate from both disposal structures. In both the confined and unconfined aquifers, the most heavily contaminated borse skhibited marked diurnal fluctuations in fecal coliform concentrations in response to periods of effluent discharge. First arrival velocities of a rifampycin-resistant Escherichia coli tracer of approximately 15 m/day in the unconfined groundwater and 151 m/day in the confined ground water were recorded. Implications of the findings for the monitoring and management of groundwater quality beneath unsewered communities on alluvial gravel formations are briefly discussed. (Author's abstract) W87-00338

LEACHABLE AND TOTAL PHOSPHOROUS IN URBAN STREET TREE LEAVES, North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.

ronmental Management.
J. R. Dorney.
Water, Air, and Soil Pollution WAPLAC, Vol. 28,
No. 3/4, p 439-443, April 1986. 1 tab, 19 ref.

Descriptors: *Phosphorus, *Water pollution sources, *Trees, Leaves, Urban runoff, Runoff.

Urban runoff contains large quantities of a variety of pollutants, including P but there have been few descriptions of the sources of these pollutants. An average of 148 microgram/gram (air-dried weight) of P was leachable from entire tree leaves in 2 hr: this represented 9.3% of the total P available. The amount of leachable and total leaf P varied significantly among tree species but was not affected by tree diameter. These results point to a possible important source of phosphorus from urban runoff. (Author's abstract) (Author's abstract) W87-00340

INFLUENCE OF GEOLOGY ON LAKE ACIDI-FICATION IN THE ILWAS WATERSHEDS, Colgate Univ., Hamilton, NY. Dept. of Geology. R. April, and R. Newton. Water, Air, and Soil Pollution WAPLAC, Vol. 26, No. 4, p 373-386, December 1985. 7 fig, 5 tab, 13

Descriptors: *Acid rain, *Soil types, *Acidic water, *Lakes, *Alaklinity, *Geology, Watersheds, Catchment areas, Woods Lake Watershed, Rain-fall, New York, Adirondack Mountains, Panther Lake Watershed, Chemical properties.

Three lake-watersheds in the Adirondack Mountains of New York State, underlain by similar granitic bedrock and receiving similar levels of acidic deposition, were found to have very differnt surface water alkalinities. The chemical differences appear to be due to differences in the unconsolidated surficial materials in the basins. Woods Lake watershed (mean lake outlet pH of 4.7) is covered by thin till with many interspersed bedrock outcrops. The thinness of these surficial deposits (average depth 2m) limits the amount of deep percolation of water and thus contact with alkalinity-producing inorganic horizons. In contrast, Panther Lake watershed (mean lake outlet pH of 6.2) is covered by thick glacial till (average depth 24m.) More of the precipitation comes in contact here with the alkalinity-producing materials. Sagamore Lake watershed is much larger and has areas of both thick and thin deposits and lake outlet pH values intermediate to those of Woods and Panther lakes. The soils in all three watersheds are dominated by quartz, potassium feldspar and sodic plagicclase with minor amounts of hornblende and other heavy minerals. The dominant clay mineral is vermiculite. Chemical evidence suggests the present rate of mineral weathering is less than the long-term rate in Woods Lake watershed while in Panther, the present rate may have increased relative to the long-term rate. (Author's abstract) W87-00342

HYDROGEOLOGIC COMPARISON OF AN ACIDIC-LAKE BASIN WITH A NEUTRAL-LAKE BASIN IN THE WEST-CENTRAL ADI-RONDACK MOUNTAINS, NEW YORK, Geological Survey, Atlanta, GA. Water Resources

N. E. Peters, and P. S. Murdoch. Water, Air, and Soil Pollution WAPLAC, Vol. 26, No. 4, p 387-402, December 1985. 6 fig, 3 tab, 20

Descriptors: "Acid rain, "Lakes, "Groundwater, Groundwater pollution, Rainfall, Air pollution, Acidic water, Panther Lake, Watersheds, New York, Adirondack Mountains, Neutral lakes, Woods Lake, Hydrogen ion concentration.

Woods Lake, Hydrogen ion concentration.

Two small headwater lake basins that receive similar amounts of acidic atmospheric deposition have significantly different lake outflow pH values; pH at Panther Lake (neutral) ranges from about 4.7 to 7; that at Woods Lake (acidic) ranges from about 4.8 to 5. A hydrologic analysis, which included monthly water budgets, hydrograph analysis, examination of flow duration and runoff recession curves, calculation of ground-water storage, and an analysis of lateral flow capacity of the soil, indicates that differences in the ground-water contribution to the lakes. A larger percentage of the water discharged from the neutral lake is derived from ground water than that from the acidic lake. Ground water has a higher pH resulting from a sufficiently long residence time for neutralizing chemical reactions to occur with the till. The difference in ground-water contribution is attributed to a more extensive distribution of thick till (<3 m) in the neutral-lake basin than in the acidic-lake basin; average thickness of till in the neutral-lake basin is 24 m whereas that in the other is 2.3 m. During the snowmelt period, sometimes as much as three months of accumulated precipitation may be released within two weeks causing the lateral flow capacity of the deeper mineral soil to be exceeded in the neutral-lake basin. This excess water moves over and through the shallow acidic soil horizons and causes the lakewater pH to decrease during snowmelt. (Author's abstract)

DELINEATION OF CHEMICALLY POLLUT-ED GROUNDWATER REGIONS IN VISAKHA-PATNAM BASIN, INDIA,

Andhra Univ., Waltair (India). Dept. of Geophys-

V. V. J. Sarma, and A. N. Swamy. Water, Air, and Soil Pollution WAPLAC, Vol. 29, No. 1, p 15-26, May 1986. 5 fig, 9 ref.

Descriptors: *Industrial Wastes, Irrigation, *Ur-banization, *Groundwater pollution, Geologic for-mations, Chemical wastes, Water quality, Ef-fluents, India, Visakhapatnam.

Water quality investigations were carried out in the Visakhapatnam basin to delineate groundwater pollution. The groundwater in some localities of the basin is contaminated due to natural geological formation sources, industrial effluents, irrigation, and urbanization. The ring average method used in geophysical interpretation to separate regional and residual anomalies was modified and applied to the water quality data in the basin to locate chemically polluted groundwater regions. The method can be applied successfully to delineate regions of groundwater pollution and may also be helpful in identifying the sources. (Author's abstract)

ATMOSPHERIC DEPOSITION AT ROTH-AMSTED, SAXMUNDHAM, AND WOBURN EXPERIMENTAL STATIONS, ENGLAND,

EXPERIMENTAL STATIONS, ENGLAND, 1969-1984, Rothamsted Experimental Station, Harpenden (England). Dept. of Soils and Plant Nutrition. K. W. T. Goulding, P. R. Poulton, V. H. Thomas, and R. J. B. Williams. Water, Air, and Soil Pollution WAPLAC, Vol. 29, No. 1, p 27-49, May 1986. 11 fig, 2 tab, 36 ref.

Descriptors: "Acid rain, "Air pollution, "Water pollution source, "Precipitation, "Chemistry of precipitation, "Hydrogen ion concentration, "Ca-tions, Acidity, Anions, England, Rothamsted, Sax-mundham, Woburn, Fertilizers, Nitrates.

The pH of precipitation, and the concentrations in precipitation and depositions by precipitation of H(+), major cations, N, S, and chloride were measured in bulk collectors at three sites in Eastern England. The Rothamsted site is 100 km from the coast in a semi-urban environment. The Saxmund-ham site is 13 km and the Woburn site 120 km from coast in a semi-urban environment. The sammulams site is 13 km and the Woburn site 120 km from the coast, both are in rural environments. Precipitation is acidic at all three sites, with pH of 4.3 at Rothamsted and 5.0 at Saxmundham and Woburn at present, but the pH has been increasing. Precipitation chemistry is chiefly controlled by sea-salts (Na,Mg,CL) and earth salts (K, Ca, Mo, NH4, NO3). Sea-salts dominate near the coast at Saxmundham, but earth salts become much more important inland at Rothamsted and at Woburn. The concentration and deposition of non-sea Cl are increasing at Woburn, and those of NO3-N are increasing at Woburn, and those of NO3-N are increasing at all sites. Precipitation acidity is associated chiefly with non-sea SO4, and only a little with NO3 and non-sea Cl at Rothamsted and Woburn. At Saxmundham, no correlation between acidity and anions is observed, presumably because of the overwhelming effect of sea-salts. (Author's abstract) W87-00346

HEAVY METAL CONTENT OF SOME SOLID WASTES IN IBADAN, NIGERIA, Ibadan Univ. (Nigeria). Dept. of Preventive and Social Medicine.

M. K. C. Sridhar, and A. O. Bammeke. Water, Air, and Soil Pollution WAPLAC, Vol. 29, No. 1, p 51-56, May 1986. 3 tab, 14 ref.

Descriptors: *Solid wastes, *Municipal wastes, *Heavy metals, *Nigeria, Trace metals, Path of pollutants, Leaching, Hydrogen ion concentration.

The heavy metal contents of some solid wastes produced in residential areas, a market, a cafeteria and the composts in Ibadan, Nigeria, were measured. The solid wastes produced in low density areas with higher per capita income showed higher levels of many heavy metals. The cafeteria waste showed low levels of some of these metals. Com-

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posts had high levels of some metals. The solid wastes dumped on roadsides enter streams and rivers which may leach out the heavy metals. In parts of Lagos some of the waters are highly acidic (pH = 3.4) which accelerates the dissolution of heavy metals. (McFarlane-PTT) W87-00347

ENVIRONMENTAL FATE OF MERCURY DIS-CHARGED INTO THE UPPER WISCONSIN

Wisconsin Univ.La Crosse. River Studies Center. R. G. Rada, J. E. Findley, and J. G. Wiener: Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 1, p 57-76, May 1986. 6 fig, 6 tab, 59 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Pulp wastes, *Mercury, *Rivers, *Sediments, *Fish, Crayfish, Carp, Wisconsin River, Surficial sediments, Pulp and Paper industry.

The distribution of Hg in sediments, fish, and cray-fish was studied in a 60 km reach of the Upper Wisconsin River that formerly received Hg in wisconsin River that formerly received rig m discharges from pulp and paper mills. The most heavily contaminated strata of sediments were deposited during the 1950s and the early 1960s and buried under subsequent deposits; however, surficial sediments remained substantially enriched at certain sites in 1981 Median concentrations of the certain sites in 1981. Median concentrations of Hg in surficial sediments, adjusted for grain size, were at least 10-fold greater at the main study area than at an upstream reference site. Total concentrations exceeded 1.0 microgram/g wet weight in axial muscle tissue in only 2 of 173 fish analyzed from the study area; however, historical comparisons revealed that Hg contamination of fish (common carp Cyprinus carpio and walleye Stizostedion virteum vitreum) and crayfish (Orconectes) in the river had not decreased since the early 1970s. The availability of Hg to biota in this system may be enhanced by rapid methylation of the metal in surficial sediments, despite burial of the most heavily contaminated sediments. Management practices for this river should be designed to prevent condicertain sites in 1981. Median concentrations of Hg oystem may be inethylation of the metal in ily contaminated sediments. Management practices for this river should be designed to prevent conditions favoring mobilization of Hg in sediments (Author's abstract)

TRACE METAL CONCENTRATIONS IN MARINE ORGANISMS FROM ST. VINCENT GULF, SOUTH AUSTRALIA, Canberra Coll. of Advanced Education, Belconnen

(Australia). Water Research Centre. W. A. Maher. W. A. Maher. Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 1, p 77-84, May 1986. 1 fig, 7 tab, 17 ref.

Descriptors: *Path of pollutants, *Trace metals, *Fish, *Mollusks, Metals, Aquatic fauna, Crustaceans, Macrophytes, Ecosystems, South Australia, St. Vincent Gulf, Copper, Cadmium, Lead, Zinc.

Trace metal concentrations were measured in the tissues of fish, molluscs, crustaceans and macro-phytes from St. Vincent Gulf, South Australia to assess the extent of trace metal pollution from urban and industrial wastes. The concentrations of the measured metals (Cd < 0.025 to 2.1 microgram/g, Cu 0.51 to 91 microgram/g, Pb 0.02 to 3.6 microgram/g, Zn 15 to 110 microgram/g) are similar to those from unpolluted areas and thus give no indication of pollution. (Master-PTT)

OXYGEN RESOURCES OF THE HYPOLIM-NION OF IONICALLY ENRICHED ONONDA-GA LAKE, NY, U.S.A., Upstate Freshwater Inst., Inc., Syracuse, NY. S. W. Effler, M. G. Perkins, and C. Brooks. Water, Air, and Soil Pollution WAPLAC, Vol. 29, No. 1, p 93-108, May 1986. 11 fig, 1 tab, 51 ref.

Descriptors: *Oxygen depletion, *Dissolved oxygen, *Sulfides, *Eutrophic lakes, Hypolimnion, Onondaga Lake, Seasonal variation, Industrial wastes, Vertical distribution, Stratification, Phyto-

The depletion of hypolimnetic dissolved oxygen and the upper depth boundary of anoxia for four

consecutive years (1978-81) and the accumulation of sulfide for a single year (1981) were documented for ionically enriched hypereutrophic Onondaga Lake, NY, USA. The depletion rate, as a real hypolimnetic oxygen deficit, was extremely high (1.2-2.7 g/sq m/d). The large differences in the rate within individual years and from year to year were largely a result of differences in attendant vertical mixing. The entire hypolimnion (depth interval from I to 20 m) was without oxygen by late June of all 4 years. Anoxia was observed above the hypolimnion on some occasions when secondary stratification occurred. Sulfide accumulated progressively in the hypolimnion in 1981 following the onset of anoxia to a volume weighted concentration of 11 mg/L. The ionic discharge from an adjoining alkali manufacturer exacerbated the problem of limited oxygen resources of the hypolimnion by: (1) decreasing vertical mixing, (2) prolonging the duration of stratification, (3) causing abbreviated turnovers, and (4) encouraging increased rates of phytoplankton settling. (Au-W87-00351) thor's abstract) W87-00351

KINETIC CONCEPTS FOR MEASURING MI-CROBIAL RATE CONSTANTS: EFFECTS OF NUTRIENTS ON RATE CONSTANTS,

D. F. Paris, and J. E. Rogers.
Applied and Environmental Microbiology
AEMIDF, Vol. 51, No. 2, p 221-225 February
1986. 1 fig, 5 tab, 19 ref.

Descriptors: *Path of pollutants, *Organic matter, *Microbial degradation, *Microbiological studies, *Nutrients, Nitrogen, Phosphorus, Iron, Magnesium, Rate constants, Incubation, Xenobiotic com-

The effect of preincubation of environmental waters amended with inorganic nutrients (nitrogen, phosphorus, and traces of iron and magnesium) on the kinetics of the microbial transformation of the kinetics of the microbial transformation of phenol, propanil, propyl ester of (2,4-dichlorophenoxy)acetic acid, methyl parathion, Ronnel, and methoxychlor in pond and river waters was investigated. No effect on the second-order rate constants for these compounds was observed with the contract of t served, although there was an increase in the bac-terial populations and the pseudo-first-order rate constants. The use of nutrient-amended waters constants. The use of nutrient-amended waters could be a useful tool for estimating second-order rate constants for an expanded number of compounds. This technique would provide a larger data base for predicting the behavior of xenobiotic compounds in the environment by using currently available mathematical models. (Author's abstract) W87-00354

ANOMALIES IN MINERALIZATION OF LOW CONCENTRATIONS OF ORGANIC COMPOUNDS IN LAKE WATER AND SEWAGE, Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.

D. G. Hoover, G. E. Borgonovi, S. H. Jones, and

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 226-232, February 1986. 8 fig. 16 ref. USDA-TPSU-CU-2057-261 and Public Health Service Training Grant ES-07052.

Descriptors: "Path of pollutants, "Lakes, "Wastewater, "Nitrilotriacetic acid, "Mineralization, Organic compounds, Nitrophenol, Aniline, Isopropyl N-phenylcarbamate, 2,4-dichlorophenoxyacetic acid, Pollution.

The rates of mineralization of nitrilotriacetic acid The rates of mineralization of nitrilotriacetic acid (2.4-D) p-nitrophenol, aniline, and isopropyl N-phenylcarbamate (IPC) at one or more concentrations ranging from 100 picogram/ml to 1.0 microgram/ml were proportional to chemical concentrations in samples of three lakes. The rates at 100 picogram of N1A, 2,4-D, p-nitrophenol, and aniline per ml in samples of one or more lakes were less than predicted, assuming the rates were linearly related to the concentration. Neither NTA nor 2.4 dichloroassuming the rates were linearly related to the concentration. Neither NTA nor 2,4 dichlorophenol at 2.0 nanogram/ml was mineralized in some lake waters, but higher levels of the two

chemicals were converted to CO2 in samples of the same waters. The mineralization in sewage of 1.0 microgram of NTA per ml was biphasic; about 20% of the substrate was mineralized in 20 h, and mineralization was only reinitiated after a period of 130 h. NTA also underwent a biphasic mineraliza-tion in lake waters, and the biphasic pattern was not altered by additions of growth factors and inorganic nutrients. From 40 to 60 of the carbon of sulfine added to lake water at leads of 100 pione. not altered by additions of growth factors and inorganic nutrients. From 40 to 60 of the carbon of aniline added to lake water at levels of 100 picogram/ml to 1.0 microgram/ml was mineralized. Conclusions reached from tests of biodegradation at high concentrations of chemicals may not apply to the low levels found in many natural environments. (Author's abstract)
W87-00355

NITRIFICATION RATES IN THE BALTIC SEA: COMPARISON OF THREE ISOTOPE TECH-

Goeteborg Univ. (Sweden). Dept. of Marine Microbiology. bibliographic entry see Field 5A.

BIODEGRADATION OF TERT-BUTYL-PHENYL DIPHENYL PHOSPHATE, National Center for Toxicological Research, Jef-

M. A. Heitkamp, J. P. Freeman, and C. E.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 316-322, February 1986. 3 fig, 4 tab, 25 ref.

Descriptors: *Biodegradation, *Microbial degrada-tion, *Organic compounds, *Path of pollutants, Sediments, Aquatic plants, Agriculture runoff, Or-ganophosphorous compounds.

Biodegradation of tert-butylphenyl diphenyl phosphate (BPDP) was examined in microcosms containing sediment and water from five different ecosystems to elucidate the environmental fate of phosphate ester flame retardants. Biodegradation of (14C)BPDP was monitored in the environmental microcosms by measuring the evolution of (14C). Over 37% of BPDP was mineralized after 8 weeks in interconcern the second properties which tai microcosms by measuring the evolution of (14C). Over 37% of BPDP was mineralized after 8 weeks in microcosms from an ecosystem which had chronic exposure to agricultural chemicals. In contrast, only 1.7% of BPDP was degraded in samples from a noncontaminated site. The exposure concentration of BPDP affected the percentage which was degraded in microcosms from the two most active ecosystems. Mineralization was highest at a concentration of 0.1 mg of BPDP and was inhibited with 10- and 100-fold higher concentations of BPDP in these microcosms. Indigenous heterotrophic and BPDP-utilizing microbial populations and phosphoesterase enzyme activities were highest in sedients which had the highest biodegradation of BPDP. Adaptive increases in both microbial populations and phosphoesterase enzymes in some acdiments acclimated to BPDP were observed. These data suggest that the microbial degradation of BPDP results from at least three catabolic processes and is highest when low concentrations of BPDP are exposed sediment microorganisms of eutrophic ecosystems which have high promboth; and distances activities and activities and activities and distances activities and activities and distances activities and activities and distances ac sions of BPDP are exposed sediment microorga-nisms of eutrophic ecosystems which have high phosphotri- and diesterase activities and previous exposure to anthropogenic chemicals. (Author's abstract) W87-00360

SENSITIVITY OF MOORE SEWER SWABS FOR ISOLATING SALMONELLA TYPHI, Maryland Univ. at Baltimore. School of Medicine. For primary bibliographic entry see Field 5A. W87-00363

ATMOSPHERIC CONCENTRATIONS AND THE DEPOSITION VELOCITY TO SNOW OF NITRIC ACID, SULFUR DIOXODE AND VARI-OUS PARTICULATE SPECIES, General Motors Research Labs., Warren, MI. En-vironmental Science Dept. S. H. Cadle, J. M. Dasch, and P. A. Mulawa. Atmospheric Environment ATENBP, Vol. 19, No.

Sources Of Pollution—Group 5B

11, p 1819-1827, November 1985. 7 fig, 2 tab, 15

Descriptors: *Acid rain, *Snow, *Sulphur dioxide, *Air pollution, *Nitric acid, Deposition, Deposition velocity, Particle size, Particulate matter.

a study of deposition velocities to snow was conducted during the 1982-83 and 1983-84 winters at the University of Michigan Biological Station in northern Michigan. Weekly measurements were made of dry deposition rates to snow and the atmospheric concentrations of the depositing species. NO2, with an average concentration of 2.2 ppb, was the dominant atmospheric sulfur containing species. NO3 (-) deposition was due primarily to HNO3, which averaged 0.2 ppb, The HNO3 deposition velocity averaged 1.4 cm/s. The SO2 deposition velocity varied with temperature, averaging 0.15 cm/s for samples with appreciable exposure time above -3 C and 0.06 cm/s for samples which remained below an ambient temperature of -3 C. Deposition velocities of Ca(2+), Mg(2+), Na(+) and NH4 (+) were 2.1, 1.5, 0.44, 0.51 and 0.10 cm/s respectively. The mass median diameters of these species were 4.4, 2.7, 1.8, 0.9 and 0.46 micrometer respectively. (Author's abstract) W87-00364

SPACE-TIME DISTRIBUTION OF SULFATE DEPOSITION IN THE NORTHEASTERN UNITED STATES, Consolidation Coal Co., Pittsburgh, PA. R. A. Bilonick.

Atmospheric Environment ATENBP, Vol. 19, No. 11, p 1829-1845, November 1985. 11 fig, 2 tab, 17

Descriptors: *Acid rain, *Sulfates, *Deposition, *Spatial distribution, *Temporal distribution, United States, Northeastern United States, Semi-variograms, Mapping.

variograms, Mapping.

The space-time semi-variograms of sulfate deposition data collected by the U.S. Geological Survey during the period 1965-79 in New York State and during the winter of 1980-81 over the north central and north eastern U.S. follow well-defined patterns. These patterns were estimated and used to produce sulfate deposition maps. The spatially and temporally weighted average level of sulfate deposition was about 50 kg/ha per year for 1965-79. Individual yearly 80-km square block estimates had estimation standard deviations of about 6-9 kg/ha per year (or about 15% relative). The space-time semi-variogram exhibited a well-defined seasonal component in time and an isotropic spatial component. Sulfate deposition in the winter of 1980-81 ranged from about 5 to 12 kg/ha per year for the more northern areas, 12 to 19 kg/ha per year for the more northern areas, 12 to 19 kg/ha per year for the central region and from 19 to 26 kg 1 ha per year for 80-km square blocks. The semi-variogram for the 1980-81 data exhibited a strong anisotropy which indicated a drift in mean sulfate deposition in the north-south direction. The reasonableness of extrapolation for sulfate deposition for blocks as far as 300-400 km outside the boundary of the network is discussed. (Author's abstract) W87-00365

TWENTIETH CENTURY TRENDS IN ARCTIC AIR POLLUTION REVEALED BY CONDUC-TIVITY AND ACIDITY OBSERVATIONS IN SNOW AND ICE IN THE CANADIAN HIGH

L. A. Barrie, D. Fisher, and R. M. Koerner. Atmospheric Environment ATENB, Vol. 19, No. 12, p 2055-2063, December 1985. 7 fig, 2 tab, 18 ref.

Descriptors: *Acid precipitation, *Air pollution, *Snow, *Ice, *Arctic, Acidity, Conductivity,

Two 10-m firm cores, and one 20-m core from Agassiz ice cap and a 10-m core from the Mt.

Oxford area of the United States Range, all in N. Elleamere Island, Northwest Territories, at about 1.6 km altitude, yielded an historical record dating back to 1912 of lower tropospheric air pollution orginating mainly from Eurasia. Ice meltwater acidity and conductivity are well correlated. They are also correlated with aerosol acid concentrations in the atmosphere at nearby Alert. They undergo a strong seasonal variation paralleling that of Arctic haze. The late winter-early spring peak of conductivity is the best indicator of Arctic air pollution. It shows that in the first half of this century the level of winter-time air pollution remained roughly constant, consistent with a pattern of little change in European SO2 emissions. However, between 1936 and 1977 there has been a 75% increase of Arctic air pollution which is associated with a marked increase in SO2 and NOx emissions in Europe. In the second half of this century, the progressive increase in Arctic air pollution has caused the winter acidity of the N. Ellesmere snowpack to rise from about 8 microequivalents/lambda in 1936 to about 14 microequivalents/lambda in 1977. (Author's abstract) W87-00366

ATMOSPHERIC TRANSPORT AND DEPOSITION OF TRACE ELEMENTS ONTO THE GREENLAND ICE SHEET, Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
C. I. Davidson, S. Santhanam, R. C. Fortmann, and M. P. Olege.

and M. P. Olson.

Atmospheric Environment ATENBP, Vol. 19, No. 12, p 2065-2081, December 1985. 7 fig. 6 tab, 64 ref. NSF Grant DPP-8020928, Claude Worthington Benedum Foundation Grant 1-31335.

Descriptors: *Air pollution, *Path of pollutants, *Ice, Snow, *Deposition, *Trace elements, Greenland ice sheet, Particulate matter, Sulfates, Nitrates, Precipitation.

Airborne particles of diameter > 0.4 micro n reaching Dye 3, Greenland during April-May 1983 were analyzed for size and concentration. Lower concentrations and smaller sizes were associated with transport from the south. Dye 3 may receive material emitted from Eurasian sources and transported over the Pole. Material collected during three snowstorms where ice nucleation dominated provided data used to estimate mass-basis scavenging ratios. Average scavenging ratios were in the three snowstorms where ice nucleation dominated provided data used to estimate mass-basis scavenging ratios. Average scavenging ratios scavenging ratios were in the range 1000-2000 for the crustal elements Al, Fe, K, Mg, Mn, and Na. Similar values were obtained for Cd, Cu and NO3(-). The corresponding ratios for Pb and SO4 (2-) averaged less than 200. Wet deposition velocities of 2 cm/s were estimated for the first nine species, and 0.2 cm/s for Pb and SO4(2-) Comparing fresh and older surface snow concentrations gave an average dry deposition velocity of roughly 0.2 cm/s for the crustal elements, with the small fraction of large particles (approx. 5-10 micron) dominating deposition. When used with other data in the literature, the results suggest that total deposition velocities of Pb and SO4 may be as small as 0.05 cm/s in relatively dry regions of the Arctic. (Author's abstract)

BACTERIAL ABUNDANCE IN RELATION TO SURFACE AREA AND ORGANIC CONTENT OF MARINE SEDIMENTS,

STARKLINE SELDIMENTS, State Univ. of New York at Stony Brook. Dept. of Ecology and Evolution. For primary bibliographic entry see Field 2L. W87-00368

SULFUR CONSTITUENTS AND CYCLING IN WATERS, SESTON, AND SEDIMENTS OF AN OLIGOTROPHIC LAKE, State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. For primary bibliographic entry see Field 2H. W87-00379

VULNERABILITY OF ALLUVIAL GROUND-WATERS TO THEIR AGRICULTURAL AND CLIMATIC ENVIRONMENT (A PROPOS DE

LA VULNERABILITE DES NAPPES ALLU-VIALES A L'ENVIRONNEMENT AGROCLI-MATIQUE),

ellier-2 Univ. (France). J. C. Grillot.

Comptes Rendus de l'Academie des Sciences, Paris, Series 2 CHDCAQ, Vol. 302, No. 8, p 605-608, Feb. 28, 1986. 2 fig, 7 ref.

Descriptors: *Groundwater pollution, *Alluvial aquifers, *Path of pollutants, Aquifers, Groundwater irrigation, Agriculture, Climate, Hydrochemistry, Pollution, Montmorillonite, Temperature effects.

Analyzing the evolution in time of the hydrochemistry of an alluvial groundwater within the framework of its agricultural and climatic context, vields information on the arms of the context, rramework of its agricultural and climatic context, yields information on the possible ways the groundwater can be polluted: (1) transfer of solutes between the surface and the groundwater under the control of climatology, of the periods and types of agricultural activities, or the sedimentary between this of watering and the periods. heterogeneities, of watering and the temperature of water, and (2) cationic exchanges that are provoked by clays of mainly Montmorillonite type. (Author's abstract)

W87-00384

CADMIUM SOIL SORPTION AT LOW CON-CENTRATIONS: III, PREDICTION AND OB-SERVATION OF MOBILITY, Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering. T. H. Christensen.

Water, Air, and Soil Pollution WAPLAC, Vol. 26, No. 3, p 255-264, November 1985. 4 fig. 2 tab, 10

Descriptors: *Soil water pollution, *Cadmium, *Soil absorption capacity, *Sorption, Solute velocity equations, Freundlich isotherms, Linear isotherms ity equations, erms. Mobility

rnas, Moduity.

The applicability of relative solute velocity equations (based on Freundlich isotherm and linear isotherm) for predicting the migration of low concentrations of Cd under intermittent flow conditions was studied using eleven small laboratory soil columns monitored for 600 days in terms of Cd breakthrough curves. The predicted Cd velocities (based on previously reported batch experimental results) agreed well with the column observations. The soils studied showed only slightly curvelinear equilibrium isotherms and the use of the Freundich isotherm based equation in preference to the linear distribution based equation was not justified. The use of the relative solute velocity equations for intermittent flow conditions requires that the relative solute velocity is interpreted as a relative Darcy-velocity and that the water saturated porosity is employed in the equations. The observed relative Cd velocities were 0.0015 to 0.002 indicating a very limited mobility. (Author's abstract) W87-00386

ONE PROBLEM OF ACID RAIN: ALUMINUM, Oxford Univ. (England). Inorganic Chemistry

Journal of Inorganic Biochemistry JIBIDJ, Vol. 26, No. 1, p 35-44, January 1986. 2 fig, 2 tab, 2 ref.

Descriptors: *Aluminum, *Acid rain, *Air pollution, Rainfall, Cations, Equilibrium distribution.

The equilibrium distribution of different cations The equilibrium distribution of different cations M(m+) was analyzed, where m goes from 1 to 3 so that M can be the proton, a calcium, or an aluminum ion, with ligands, RO(n-), where the pK sub a of the acid HnoR can be small or large. The competition from aluminum for calcium sites can be very considerable in more acidic media. The problem of acidification is complicated by solid/solution reactions which are not necessarily reversed by reversing the pH changes since the conditions under which the solids dissolve and the aluminum reprecipitates are not the same. (Aualuminum reprecipitates are not the same. (Au thor's abstract)

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REGULATORY DEVELOPMENT OF THE IN-TERIM AND REVISED REGULATIONS FOR RADIOACTIVITY IN DRINKING WATER -PAST AND PRESENT ISSUES AND PROB-

Environmental Protection Agency, Washington, DC. Office of Drinking Water.
W. L. Lappenbusch, and C. R. Cothern.
Health Physics, Vol. 48, No. 5, p 535-551, May 1985. 6 fig, 2 tab, 23 ref.

Descriptors: *Regulations, *Radioactivity, *Drinking water, Isotope studies, Human physiology, Maximum contaminant level, Radioactivity effects.

Developing the Revised Regulations of Radioactivity in Drinking Water under the Safe Drinking Water Act requires more information from related fields and disciplines. As one step in the regulatory process, the background and history of that process as it applies to radioactivity in drinking water is described. The issues involved in developing the revised regulations are as follows: monitoring all sources of exposure, dose evaluation, health effects, engineering, economics and general policy development. (Author's abstract)

FIELD STUDY OF RA ACCUMULATION IN TROUT WITH ASSESSMENT OF RADIATION DOSE TO MAN

DOSE TO MAN, Colorado State Univ., Fort Collins. Dept. of Radiology and Radiation Biology. S. K. Ropes, and F. W. Whicker. Health Physics, Vol. 49, No. 2, p 247-257, August 1985. 4 fig, 5 tab, 29 ref.

Descriptors: *Radioactive wastes, *Path of pollutants, *Trout, *Sport fishing, *Radium radioisotopes, *Land reclamation, *Uranium, Artifical lakes, Radioactivity effects, Calcium, Population exposure, Mine wa

Because one reclamation plan proposed formation of an artificial lake near an open pit uranium mine, a study was conducted to determine the concentra-tions of 226-Ra in trout from four nearby surface astasty was considered to technise the contentas trions of 226-Ra in trout from four nearby surface ponds. Radium and calcium accumulation in trout flesh, skin, fins and bone were measured. Observed ratios of Ra/Ca in fish tissue divided by Ra/Ca in water were higher in tissues of fish which had been in the ponds for a longer period, thus indicating that 226-Ra concentrations may increase with continued exposure. The calculated dose equivalent commitment to human endosteal tissue ranged from 0.2-2 millitems/yr per fish depending on dietary and environmental factors. The estimated annual dose equivalent rates ranged from 1.0-83 millitems per year for an individual who consumed one fish per week for 50 years. It is concluded that the dose to man from ingestion of 226-Ra in fish would not preclude establishment of a recreational lake at this site. (Alexander-PTT)

ORIGIN OF LIN SOIL AND THE 129-I PROP-

LEM, Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
B. L. Cohen

Health Physics, Vol 49, No. 2, p 279-285, August 1985, 24 ref.

Descriptors: *Iodine, *Iodine radioisotopes, Oceanography, Soil chemistry, Radioactive wastes, Health effects, Soil erosion, Atmospheric transport, Sedimentary rocks, Soil genesis.

The historic bases for oceanic origin of iodine in soil are analyzed and are found to disagree with modern data which shows no correlation between modern data which shows no correlation between iodine concentration in soil, and proximity to the ocean. Problems related to long distance atmospheric transport are identified, and it is shown that the balance between iodine input during soil formation by rock weathering, and iodine output from soil erosion, leaves little room for contribution from oceanic sources. Based on the transfer probability of iodine from the ocean into human food, it is concluded that not extinate of the late of the late. concluded that most estimates of very long-term ealth effects of 129-I nuclear fuel waste are much

higher than can be expected to occur. (Michael-PTT)

POTENTIAL CONTAMINATION OF SURFACE WATER SUPPLIES BY ATMOSPHERIC RE-LEASES FROM NUCLEAR PLANTS,
Nuclear Regulatory Commission, Washington,

Nuclear Regulatory Commission, DC.

R. B. Codell.

Health Physics, Vol. 49, No. 5, p 713-730, November 1985. 8 fig, 1 tab, 24 ref.

Descriptors: "Water pollution sources, "Contamination, "Drinking water, "Nuclear accidents, "Nuclear powerplants, "Surface water, New York City, Radioactivity effects, Watersheds, Reservoirs, Atmospheric transport, Water transport, Strontium radioisotopes, Cesium radioisotopes, Risks, Computer models, Groundwater, Population exposure. tion exposu

The probability and consequences of drinking water contamination resulting from an accident at a nuclear power-plant are explored using the Indian Point Nuclear Station and the New York City water supply as examples. Techniques are developed to calculate the deposition of radionuclides onto the watersheds of New York City reservoirs and to estimate the extent to which runoff from the watersheds would contaminate New York's drinking water. Computer-aided risk analysis is used to demonstrate that water supplies could be contaminated in excess of Federal limits and that population doses on the order of millions of person-rem nated in excess of Federal limits and that popula-tion doses on the order of millions of person-rem would result from serious accidents. The relative risk of this liquid pathway, however, would be small when compared to other airborne pathway risks, calculated for the same accidental release. (Michael-PTT)

FOOD-CHAIN TRANSFER OF U-SERIES RA-DIONUCLIDES IN A NORTHERN SASKATCH-EWAN AQUATIC SYSTEM,

Saskatchewan Research Council, Saskatoon.

S. M. Swanson.

Health Physics, Vol. 49, No. 5, p 747-770, November 1985. 2 fig, 21 tab, 39 ref.

Descriptors: "Path of pollutants, "Food chains, "Uranium radioisotopes, "Radium radioisotopes, "Lead radioisotopes, "Aquatic environment, Sas-katchewan, Sediment transport, Aquatic insecta, Fish, Whitefish, Contamination, Assimilation capacity, Uranium, Population exposure.

Levels of uranium, radium and lead radioisotopes in water, sediments, insects and fish were measured in a stream and lake affected by uranium mining, and in three uncontaminated systems. Organisms feeding on or near sediments had higher radionuclide levels than pelagic species. There is a potential for long-term cycling of radionuclides from sediments through food chains, due to low flux and continuous through food chains, due to low flux and continuous through food chains, due to low flux and continuous through food chains, due to low flux and continuous through food chains, due to low flux and continuous through food chains, due to low flux and continuous through the flux and continuous through the flux and t sediments through rood chains, due to low hux and sedimentation rates. Transfer coefficients (TCs) were generally low and control TCs were greater than TCs in contaminated areas. TCs for radium and lead radioisotopes declined dramatically at the insect-fish level. Uranium uptake from water by insects and fish was much less than the uptake of radium and lead radioisotopes. Uptake from sedi-ments was similar for all nuclides in insects. The ments was similar for all nuclides in insects. In e-critical pathway in the contaminated area was sedi-ments to insects to forage fish to whitefish to man. Doses to humans consuming one serving of fish per week for one year was 2% of the International Commission on Radiological Protection annual limit for the general public. (Michael-PTT)

TRANSFER OF 137CS AND 60CO IN A WASTE RETENTION POND WITH EMPHASIS ON AQUATIC INSECTS, Virginia Polytechnic Inst. and State Univ., Blacks-

J. R. Voshell, J. S. Eldridge, and T. W. Oakes. Health Physics, Vol. 49, No. 5, p 777-789, November 1985. 2 fig. 4 tab, 32 ref.

Descriptors: *Path of pollutants, *Cesium radioisotopes, *Cobalt radioisotopes, *Settling basins, *Nuclear powerplants, *Radioactive wastes, *Aquatic insects, Filtered wastewater, Algae, Sediments, Seston, Plankton, Seasonal variation.

Research was conducted to analyze transfer of 137Cs and 60Co to aquatic insects in a retention pond and to determine if detectable concentrations of the radionuclides are exported by the emerging insects. Radionuclide concentrations were analyzed in samples of water solution, bottom sediments, suspended particulate matter, plankton, floating mats of filamentous algae, benthic macroinvertebrates and emerging aquatic insects. There were considerable temporal variations as the radionuclides cycled among abiotic and biotic components of the pond. It was concluded that adult aquatic insects would be effective biological monitors of nuclear facilities because emerging adults contain detectable concentrations of radionuclides, have relatively long life spans and disperse away from the aquatic habitat. (Michael-PTT) W87-00418

MODELLING OF THE TRANSPORT OF CHLORINATED HYDROCARBON SOLVENTS IN GROUNDWATER: A CASE STUDY, Stuttgart Univ. (Germany, F.R.). Inst. fuer Was-

serosut. W. K. H. Kinzelbach. Water Science and Technology WSTED4, Vol. 17, No. 9, p 13-21, September 1985. 4 fig, 8 ref.

Descriptors: *Path of pollutants, *Groundwater pollution, *Groundwater, *Model studies, *Pollution, Chlorinated hydrocarbons, Hydrocarbons, Decontamination, Water quality, 1,1,1-trichloroethane, Randon-walk models.

At present chlorinated hydrocarbon solvents rank among the major pollutants found in groundwater. In the interpretation of field data and the planning of decontamination measures numerical transport models may be a valuable tool of the environmental engineer. The applicability of one such model is tested on a case of groundwater pollution by 1,1,1,trichloroethane. The model is composed of a horizontally 2-D flow model and a 3-D 'random-walk' transport model. It takes into account convective and dispersive transport as well as linear adsorptransport model. It takes into account convective and dispersive transport as well as linear adsorption and a first order decay reaction. Under certain simplifying assumptions the model allows an adequate reproduction of observed concentrations. Due to uncertainty in data and limited comparability of simulated and measured concentrations the model parameters can only be estimated within bounds. Decay rate of parameters can only be estimated within bounds. Decay rate of 1,1,1-trich-prochange is estimated to lie between 0 and 0,0005 loroethane is estimated to lie between 0 and 0.0005 l/d. (Author's abstract) W87-00421

MOBILIZATION OF HEAVY METALS IN RIVER SEDIMENT BY NITRILOTRIACETIC ACID (NTA).

ACLD (NTA), Rijksinstituut voor de Volksgezondheid en Milieu-hygiene, I. "idschendam (Netherlands). J. P. G. Loch, and P. Lagas. Water Science and Technology WSTED4, Vol. 17, No. 9, p 101-113, September 1985. 5 fig, 5 tab, 17 ref

Descriptors: *Path of pollutants, *Heavy metals, *Sediment contamination, *Nitrilotriacetic acid, Acids, *Fluvial sediments, Sediments, Pollution, Bank filtration, Rhine River, Fate of pollutants.

The mobilization of heavy metals in river and sediment by nitrilotriacetic acid (NTA) during river bank filtration was investigated in the labora-tory under oxygen-deficient conditions. Four PVC-columns, 1.20 m long, 0.18 m diameter, filled with river bed sediment, were percolated for 7 months with river water spiked with NTA. Water and sediment were collected from a branch of the river Rhine, where the sediment has high metal contents. The percolation rate was 10 cm/day. Supply water for three columns was kept oxygen-deficient. Water for the fourth column had an

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oxygen content of 6 mg/cu dm(-3). To the anoxic river water NTA was added to concentrations of 0, 100 and 600 microgram/cu dm(-3) respectively. The oxic water obtained an NTA-concentration of 100 microg?1. Leachate and pore water were analysed for heavy metals, inorganic macroparameters and NTA. After percolation the sediment was analysed for bound metals. When river water and sediment contained adapted micro-organisms, NTA was degraded within two weeks in all columns. There was almost no degradation during the first three weeks of percolation, due to the necessary adaptation. Except for the first month, NTA was not detected in the pore water below 10-30 cm. In the first month it penetrated into the leachate. Within the concentration range considered, neither NTA- nor O2-content of the supply water affected the mobilization of the heavy metals considered. (Author's abstract)

CONCEPTS OF SOLUTE LEACHING IN SOILS: A REVIEW OF MODELLING APPROACHES,

PROACHES, Rothamsted Experimental Station, Harpenden (England). T. M. Addiscott, and R. J. Wagenet. Journal of Soil Science, Vol. 36, No. 3, p 411-424, September 1985. 77 ref, 1 tab.

Descriptors: *Model studies, *Solutes, *Solute transport, Soil contamination, Leaching, Percolation, Infiltration.

Conceptual models for solute leaching in soil are reviewed, quantitatively compared and classified as far as possible within a framework that makes distinction between deterministic and stochastic, mechanistic and functional and rate and capacity models. They are also discussed with reference to their purpose (viz research or management), complexity, flexibility, transferability and usefulness for field soils. The basic assumptions and structures of the models impose definite limited on the ways in which they can be used. The spatial variability of soil properties caused problems for deterministic models using rate parameters, but stochastic elements can be incorporatied in these models. Simpler capacity-type models and non-mechanistic stochastic models offer other answers to this problem. Few data sets are available for testing a range of models and few models have been tested on a range of soil types, and very few models have much demonstrable ability to simulate transient field leaching conditions. Examples of a model being tested by someone other than the developer are rare. (Author's abstract)

CHLOROPHYLL-TOTAL PHOSPHORUS RE-LATIONSHIPS IN LAKE BURRAGORANG, NEW SOUTH WALES, AND SOME OTHER SOUTHERN HEMISPHERE LAKES, Tasmania Univ., Hobart (Australia). Dept. of Botany. For primary bibliographic entry see Field 2H. W87-00427

HEAVY METAL CONCENTRATIONS IN THE OYSTERS SACCOSTREA CUCCULLATA AND SACCOSTREA SP. FROM THE DAMPIER ARCHIPELAGO, WESTERN AUSTRALIA, Western Australia Dept. of Conservation and Environment, Perth. For primary bibliographic entry see Field 5C. W87-00428

IODINE AND ARSENIC REDOX SPECIES IN OXYGEN-DEFICIENT ESTUARINE WATERS, McIbourne Univ., Parkville (Australia). Marine Chemistry Lab.
For primary bibliographic entry see Field 2L. W87-00429

MODELING OF DISSOLVED SOLIDS IN A RIVER USING FLOW COMPONENTS (MO-DELISATION DES SOLIDES DISSOUS EN RI-VIERE A L'AIDE DES COMPOSANTES DE L'ECOULEMENT),

Institut National de la Recherche Scientifique, Institut National de la Recherche Scientinque, Sainte-Foy (Quebec). G. Morin, D. Couillard, D. Cluis, H. G. Jones, and J. M. Gauthier. Canadian Journal of Civil Engineering CJCEB, Vol. 13, No. 2, p 196-202, April 1986. 4 fig, 3 tab,

Descriptors: *Model studies, *Water quality, *Stream flow-water quality relations, *Rivers, *Dissolved solids, Flow, Runoff, Interflow, Base flow, Conceptual models, Watersheds, Quebec, Industrial wastes, Municipal wastes.

dustrial wastes, Municipal wastes.

A model is proposed to calculate the concentrations of dissolved solids in rivers at any point within a watershed, using the components of a conceptual hydrological model. The watershed is divided grid-wise into parcels for each of which a daily mass balance is computed. This mass balance takes into account the dissolved solids loads associated with three inflows considered by the hydrological model, namely surface runoff, interflow, and base flow, as well as the loads associated with municipal and industrial point sources. The model has been applied to the Sainte-Anne River, Quebec (total watershed area: 2700sq km) and the calculated values show agreement with the observed concentrations at two sampling points (Chute Panet: 1550 sq km watershed area; La Perade: 2700 sq km watershed area). (Alexander-PTT)

TRACE ELEMENT LEACHING IN BENCH-SCALE RECIRCULATING ASH TRANSPORT SYSTEMS, Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
T. W. Constable, and G. Ross.
Canadian Journal of Civil Engineering CJCEB, Vol. 13, No. 2, p 233-240, April 1986. 2 fig. 5 tab, 9 ref.

Descriptors: *Trace elements, *Path of pollutants, *Water reuse, *Leaching, *Fly ash, Heavy metals, Coal, Electric power industry, Solid waste dispos-al, Settleable solids, Water pollution control, La-

goons.

Fly and bottom ash from coal-fired power generating stations are commonly disposed by transporting the ash in a water slurry to a lagoon. New environmental codes recommend the use of recycled lagoon decant water rather than fresh makeup water for these sluicing operations. Bench-scale studies were conducted to simulate the operation of recirculating bottom ash and combined fly/bottom ash lagoon systems, and data were collected on the concentrations of trace elements in the ash sluice waters. For most ash systems, the pH of the slurry water remained relatively constant after the first two recirculation cycles, and generally was lower in a bottom ash system than in the corresponding fly/bottom ash system than in the corresponding fly/bottom ash system. The major dissolved species in the slurry waters were sulphate, calcium, and sodium. Concentrations in bottom ash systems usually increased linearly with increasing cycles of concentration, whereas concentrations in fly/bottom ash systems generally increased during the first several cycles, ten either remained constant or decreased. Scaling was observed only in studies involving fly-bottom ash from stations burning western Canadian coal or a mixture of western Canadian and U.S. bituminous coals. (McFariane-PTT)

LINEAR STOCHASTIC OPTIMIZATION AP-PLIED TO BIOCHEMICAL OXYGEN DEMAND - DISSOLVED OXYGEN MODEL-Waterloo Univ. (Ontario). Dept. of Civil Engineer-

ing.
For primary bibliographic entry see Field 5G.
W87-00446

SULFATE AND NITRATE CHEMISTRY IN CU-MULIFORM CLOUDS, Washington Univ., Seattle. Dept. of Atmospheric

D. A. Hegg, and P. V. Hobbs. Atmospheric Environment ATENBP, Vol. 20, No. 5, p 901-909, 1986. 6 tab, 37 ref. NSF Grant ATM-8112089, Coord Res Council Contract CAPA-21-

Descriptors: "Acid rain, "Chemistry of precipita-tion, "Clouds, "Sulfates, "Nitrates, Chemical prop-erties, "Nitrites, "Mathematical models, Chemical composition, Hydrogen ion concentration, Aero-sols, Oxidation, Washington State.

Chemical measurements were taken in and around cumuliform clouds over western Washington State to provide estimates of sulfate production. Values for the scavenging coefficients between the cloud base and a few hundred meters above the cloud base of sub-micron acrosols, particulate sulfate and nitrate, gaseous nitrate and total nitrate were deduced. Sulfate production and pH of the cloud water were compared for four of the camulus clouds using values obtained from an adiabatic, Lagrangian model. The measurements may be explained in terms of currently accepted aqueous SO2 oxidation mechanisms. (Michael-PTT) W87-00457

CONCENTRATIONS AND FLUXES OF TIN IN AEROSOLS AND RAIN, Florida State Univ., Tallahassee. Dept. of Ocean-

J. T. Byrd, and M. A. Andreae.
Atmospheric Environment ATENBP, Vol. 20, No. 5, p 931-939, 1986. 5 fig. 5 tab, 25 ref. NSF Grants OCE-7920183, OCE-8200931.

Descriptors: *Tin, *Path of pollutants, *Aerosols, *Trace metals, *Carbon, *Florida, *Seasonal variation, *Florituations, *Florida, *Seasonal variation, *Florituations, *Florida, *Generation, Industrial wastes, Rain, Atmospheric transport, Transport depletion, Chemistry of precipitation, Air circulation, Deposition.

Tin concentration in atmospheric aerosols was measured at land and ship-based sites in the northern and southern hemispheres. Tin concetrations were up to three orders of magnitude greater in the northern than in the southern hemisphere, indicating the importance of anthropogenic inputs to the atmospheric tin cycle. Tallahassee, FL aerosol samples showed that tin is correlated with soot carbon in air masses originating in the central U.S., but is not correlated with soot carbon that is locally produced. Factor analysis of dissolved tin and major ions in Tallahassee rainwater indicates a continental pollution source for tin. The dissolved fraction of tin in rain appears to represent only a minor component of the deposition flux and deposition rates of atmospheric tin are consistent with estimated fluxes of tin to the atmosphere. (Michael-PTT) PTT W87-00458

ATMOSPHERIC DEPOSITION OF ORGANIC CARBON TO CHESAPEAKE BAY, Old Dominion Univ., Norfolk, VA. Dept. of Mechanical Engineering and Mechanics.

J. Velinsky, T. L. Wade, and G. T. F. Wong. Atmospheric Environment ATEMBP, Vol. 20, No. 5, p 941-917, 1986. 4 fig. 1 tab, 33 ref. GPA Grant XOO322501.

Descriptors: *Chesapeake Bay, *Fallout, *Path of pollutants, Deposition, *Organic carbon, *Water sampling, *Rainfall, *Hydrocarbons, *Phytoplankton, Seasonal variation, Biogenic hydrocarbons, Wet deposition, Rivers, Drainage effects, Dry deposition, Atmospheric transport.

The concentration of organic carbon in wet and bulk deposition at four stations surrounding the lower Chesapeake Bay was measured during an 11-month study to determine the importance of atmospheric input of total organic carbon. Regional yearly wet and dry depositional rates were approximately equal; the total yearly deposition rate was 11.3 g C/sq m. The flux rates calculated for atmospheric deposition, phytoplankton production, and riverine input were 0.74, 0.91-6.8, and 4.1 x 10 to the eleventh power g C/yr, respectively. These

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figures indicate that atmospheric deposition is an important source of organic carbon to Chesapeake Bay. Similar total organic carbon (TOC) deposition rates at urban and non-urban stations indicate that localized anthropogenic inputs of organic carbon are not significant contributors to TOC deposition. (Michael-PTT)

EFFECTS OF AIRBORNE PARTICULATE MATTER ON THE ACIDITY OF PRECIPITATION IN CENTRAL MISSOURI, Missouri Univ.-Columbia. Dept. of Geology. K. R. Applin, and J. M. Jersak. Atmospheric Environment ATENBP, Vol. 20, No. 5, p 963-969, 1986. 3 fig. 2 tab. 9 ref.

Descriptors: *Acid rain, *Missouri, *Particulate matter, *Hydrogen ion concentration, *Chemistry of precipitation, Water sampling, Rainfall, Rainstorms, Dust, Deposition, Neutralization, Seasonal variation, Atmospheric transport, Illite, Kaolinite, Clay minerals, Carbonates, Calcium carbonate,

During the fall of 1983, the pH of rainfall in central Missouri was monitored at four sites. Several pH values were well above 5.6, most of which were measured after short rainfalls or during the first few hours of long rainfalls. Rainfalls associated with storm events of several days' duration showed a trend of decreasing pH over time. pH values > 5.6 seem to reflect neutralization reactions between precipitation and various components of airborne dust. Neutralization effects cradually diminish as suspended dust is washed nenus of arroome dust. Neutralization effects gradually diminish as suspended dust is washed from the atmosphere. Results of this study suggest that airborne particulate matter from the dust bowl region of the U.S. may affect precipitation chemistry hundreds of km downwind. (Michael-PTT) W87-00466

REACTIVE SCAVENGING OF POLLUTANTS BY RAIN: A MODELING APPROACH, General Motors Research Labs., Warren, MI. En-vironmental Science Dept.

S Kumar. Atmospheric Environment ATENBP, Vol 20, No. 5, p 1015-1024, 1986. 7 fig, 3 tab, 45 ref.

Descriptors: *Path of pollutants, *Water pollution sources, *Acid rain, *Absorption, *Computer models, *Chemistry of precipitation, Simulation analysis, Oxidation, Hydrogen ion concentration, Air temperature, Formaldehyde, Aerosols, Rain, Sulfates, Iron, Manganese, Mathematical models.

An Eulerian model for rain scavenging of pollutants was extended to account for absorption of multiple pollutant species and chemical reactions within raindrops. Model simulations were performed to compare the rates of S(IV) oxidation by O3 and H2O2. Comparison of the two paths indicates that oxidation by O3 dominates at pH values near or above 4.7 while oxidation by H2O2 dominates at lower values. S(IV) oxidation catalyzed by transition metals such as iron and manganese is potentially important, but there are many uncertainties regarding rates of oxidation, synergistic effects and reaction mechanisms. The effect of temperature on aqueous phase S(IV) chemistry was also studied. Sulfate concentration in raindrops increases with a decrease in temperature was also studied. Sulfate concentration in raindrops increases with a decrease in temperature
when the initial gas phase concentrations and all
other conditions remain the same. Nitrate concentration is not significantly affected by a decrease in
temperature. The decrease in sulfate concentration
in winter rains is most likely due to the fact that S
(IV) oxidation in winter is limited by availability of
oxidants. Formation of the S(IV)-HCHO adduct is
a slow process and not important for below-cloud
reactions in raindrops. It may play a role in cloud
droplets whose average lifetime is 30 minutes. (Michael-PTT) droplets who chael-PTT) W87-00463

MASS TRANSFER FROM WATER DROPLETS UNDER SIMULATED FREE FALL CONDI-

Colorado State Univ., Fort Collins. Dept. of Civil

Engineering. J. B. Wedding, Y. J. Kim, and R. S. Dennison. Atmospheric Environment ATENBP, Vol. 20, No. 5, p 1039-1045, 1986. 3 fig, 1 tab, 11 ref.

Descriptors: "Path of pollutants, "Mass transfer, "Fluid drops, "Evaporation rate, "Fall velocity, Aerosols, Wet scrubbers, Pesticides, Deposition, Temperature effects, Relative humidity, Regres-

The rates of mass transfer from water droplets under simulated free fall conditions were measured. Air that was conditioned under various temperatures and relative humidities was passed by droplets captured on a wire in a closed loop wind tunnel facility. Droplets were generated using a vibrating reed aerosol generator. Droplet diameter was determined using a long focal length microscope and droplet image was projected on to a solid state camera. Data acquired were used to obtain an equation of the Sherwood number as a function of the Reynolds and Schmidt numbers. The resulting correlation equations agreed with previous works. It is noted that the intercept value is seen to be less than the theoretical limit, thus indicating an anomaly between theory and experimental data. (Author's abstract)

NINETEENTH CENTURY BLACK SCOTTISH SHOWERS.

SHOWERS, University of East Anglia, Norwich (England). School of Environmental Sciences. P. Brimblecombe, T. Davies, and M. Tranter. Atmospheric Environment ATENBP, Vol. 20, No. 5, p 1053-1057, 1986. 3 fig. 14 ref.

Descriptors: "Path of pollutants, "Acid rain, "Scotland, "Particulate matter, "Weather patterns, "Air pollution, Snow, History, Hydrogen ion concentration, Soot, Rainfall, Weather data collection.

Black rainfalls were observed in a remote area of Scotland during convective storms in 1862 and 1863. A notional trajectory analysis using contem-porary weather observations indicates that the par-ticulates that caused the black precipitation origiticulates that caused the black precipitation originated in industrial areas hundreds of kilometers away from where the black rainfall was observed. It was concluded that under certain atmospheric conditions long range transport may have been possible over a century ago despite low fuel consumption. (Author's abstract) W87.00466

SIGNIFICANCE OF SYSTEMATIC ERROR IN RAINFALL MEASUREMENT FOR ASSESSING WET DEPOSITION,

J. C. Rodda, and S. W. Smith.

Atmospheric Environment ATENBP, Vol. 20, No.

5, p 1059-1064, 1986. 3 fig, 1 tab, 30 ref.

Descriptors: *Acid rain, *Rain gages, *Wind velocity, Network design, Water sampling, Error analysis, England, Measuring instruments, Moni-

The effect of systematic error on the accuracy of measured concentrations of deposited acidity in England is examined. Because of variations in height above the ground and differences in wind velocity, the standard rain gage systematically under registers rainfall. Real deposited acidity values can be up to 20 percent more than those reported. It is recommended that a more disciplined approach to the operation of an acid rain plined approach to the operation of an acid rain network be implemented. (Author's abstract) W87.00467

FACTORS CONTROLLING THE CONCENTRATIONS OF SOLUBLE PHOSPHORUS IN

THATIONS OF SOLUBLE PHOSPHORUS IN THE MISSISSIPPI ESTUARY, Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics.
L. E. Fox, S. L. Sager, and S. C. Wofsy.
Limnology and Oceanography LIOCAH, Vol. 30, No. 4, p 826-832, July 1985. 7 fig, 29 ref.

Descriptors: *Phosphorus, *Solubility, *Estuaries, Concentrations, Mississippi River, Suspended sediments, Sediments, Phosphates, Equilibrium, Hydrolysis, Salinity, Alkalinity.

Sediments from the Mississippi River estuary were suspended in solutions with a range of salinities and various initial concentrations of phosphate. After 42 days the suspension had nearly uniform values for the ion activity product of calcium times biphosphate ((Ca(2+))(HPO4(2))) = approx 10 to the minus 9th power sq m). Similar values were observed for this ion product in the Mississippi River and in the unper estuary. This suspess that observed for this ion product in the Mississippi River and in the upper estuary. This suggests that the concentration of soluble phosphorus may be controlled by an equilibrium with sedimentary material. The data are consistent with a mechanism where soluble phosphorus is controlled, by hydrolysis, on the surface of hydroxyapatite paraticles. Phosphorus levels in the lower estuary are primarily controlled by dilution with low-nutrient waters from the Gulf of Mexico. (Author's abstract) W87-00478 W87_00478

METABOLISM AND DISPOSITION OF 2,3,7,8,-TETRACHLORODIBENZO-P-DIOXIN IN RAINBOW TROUT, Wisconsin Univ.-Madison. Environmental Toxicol-

For primary bibliographic entry see Field 5C. W87-00481

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN METABOLISM AND DISPOSITION I YELLOW PERCH,

Wisconsin Univ.-Madison. Environmental Toxicol-For primary bibliographic entry see Field 5C. W87-00482

CONTAMINATION OF SURFACE-WATER BODIES AFTER REACTOR ACCIDENTS BY THE EROSION OF ATMOSPHERICALLY DE-

POSITED RADIONUCLIDES. Arizona State Univ., Tempe. Dept. of Mathemat-

J. C. Helton, A. B. Muller, and A. Bayer. Health Physics, Vol. 48, No. 6, p 757-771, June 1985. 9 tab, 83 ref.

Descriptors: *Path of pollutants, *Fallout, *Nuclear accidents, *Radioisotopes, *Deposition, *Erosion, *Atmospheric transport, *Surface water, Health effects, Population exposure, Data collections, Model studies, Mississippi Valley, Lake Michigan, Cesium radioisotopes, Strontium radioisotopes, S sotopes.

Data on the rate at which radioactive fallout might erode into surface water bodies following nuclear reactor accidents are used to calculate potential reactor accidents are used to calculate potential health effects of surface water contamination due to such erosion. Calculated health effects are compared with health effects associated with atmospheric and terrestrial pathways after a reactor accident. Results of this study support the belief that contamination of surface water bodies after reactor contamination to surrace water todas after reactions are related accidents by erosion of atmospherically deposited radionuclides is not an important contributor to the risk associated with reactor accidents. (Michael-PTT) W87-00487

CADMIUM IN TISSUES OF JAPANESE QUAIL FED OAT GRAIN GROWN ON MUNIC-IPAL SLUDGE-AMENDED SOIL,

New York State Coll. of Agriculture and Life Sciences, Ithaca. Toxic Chemicals Lab. C. A. Bache, G. S. Stoewsand, and D. J. Lisk.

Journal of Toxicology and Environmental Health JTEHD6, Vol. 18, No. 2, p 315-319, June 1986. 3 tab, 16 ref.

Descriptors: *Cadmium, *Tissue analysis, *Sludge utilization, Sludge amendments, Birds, Waterfowl, *Quail, *Oats, Toxicity, Chemical analysis.

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Sources Of Pollution—Group 5B

Oats were cultured on soil amended with municipal sewage sludge from Syracuse, NY, or on soil alone (control). The oats were fed to male and female Japanese quail through four generations. The extent of absorption of cadmium by the oats and its deposition in tissues and eggs of the first and fourth generations of birds were determined. The tissue levels of cadmium found in the first generation were kidney > liver > muscle approx equal to eggs, with the quail from the sludge-treatment group consistently showing the higher respective tissue levels. Female birds showed consistently higher tissue levels than those of the corresponding males. Kidney and liver tissues and eggs from the fourth generation quail fed the sludge-treatment diets were also higher than the corresponding controls, but tissues of the male quail were most often higher than the corresponding females. (Master-PTT)

NATURAL SOURCES OF ACID NEUTRALIZ-ING CAPACITY IN LOW ALKALINITY LAKES OF THE PRECAMBRIAN SHIELD, Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 2H. W87-00499

SALMONELLA CARRIAGE BY HERRING GULLS IN THE CLYDE AREA OF SCOTLAND IN RELATION TO THEIR FEEDING ECOLO-

GY, Glasgow Univ. (Scotland). Dept. of Zoology. P. Monaghan, C. B. Shedden, K. Ensor, C. R. Fricker, and R. W. A. Girdwood. Journal of Applied Ecology JAPEAI, Vol. 22, No. 3, p 669-680, December 1985. 4 fig, 4 tab, 36 ref.

Descriptors: *Seagulls, *Water pollution sources, *Path of pollutants, *Salmonella, *Feeding habits, *Waste dumps, Feces, Contamination, Wastewater outfall, Animal pathology, Scotland, Water birds.

outfall, Animal pathology, Scotland, Water birds. Herring gulls captured at waste dumps near Clyde, Scotland were examined for the presence of salmonella in their feces. The proportion of gulls carrying salmonella was positively correlated with salmonella incidence in the human population of the surrounding area. There were no significant differences in carriage rates between different classes or ages of the gulls, but there were differences between sexes during the nonbreeding season. The rate of female carriage was more than double that for males, apparently reflecting differences in feeding ecology. Gulls obtained from breeding colonies were also examined and showed a higher carriage rate than those examined at the refuse sites. It is suggested that other kinds of feeding areas may cause more frequent infection of the gulls. Salmonella did not appear to directly affect the gulls, but such pathogen carriage capabilities may cause significant public health problems, particularly when gulls roost on potable water supplies. (Michael-PTT)

PREDICTION OF ORGANIC CHEMICAL PER-MEATION THROUGH PVC PIPE, Goodrich (B.F.) Research and Development Center, Brecksville, OH. A. R. Berein. American Water Works Association Journal JAWWA5, Vol. 77, No. 11, p 57-64, November 1985. 11 fig, 1 tab, 13 ref.

Descriptors: *Fate of pollutants, *Organic solvents, *Plastic pipes, *Sorption, *Pipelines, Permeability, Water distribution, Drinking water, Diffusion coefficient, Organic compounds, Solvens, Water pollution sources, Groundwater pollution.

The transport properties of representative organic solvents at a wide range of concentrations in polyvinylchloride to assess the possibility of organic pollutants jermeating through underground PVC pipe. The rate of penetration changes by many orders of magnitude as the concentration, or activity, of solvent in the environment is varied. Softening and significant permeation of PVC pipe seems

possible only in the presence of nearly undiluted solvents or swelling agents for PVC. At lower activities, which still correspond to unusually high levels of environmental pollution, solvent transport follows ideal Fickian diffusion kinetics. Thus reliable extraolations to insulable control of the property of the pr rollows ideal Pickkan diffusion kinetics. I has reinable extrapolations to pipe walls are possible from laboratory data on PVC powders and films. The calculated permeation rates are virtually zero for many centuries, indicating that rigid PVC pipe is an effective barrier against permeation of environmental pollutants. (Authors abstract) W87-00505

DISSOLVED OXYGEN MODEL FOR A DY-NAMIC RESERVOIR, Youngstown State Univ., OH. Dept. of Civil Engi-

For primary bibliographic entry see Field 5C. W87-00518

VOLATILIZATION RATES OF ORGANIC CHEMICALS OF PUBLIC HEALTH CON-

CHEMICALS OF PUBLIC HEALTH CON-CERN, Gore and Storrie Ltd., Toronto (Ontario). Water Resources Div. T. P. H. Gowda, and J. D. Lock. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 6, p 755-776, December 1985. 3 fig, 8 tab, 26 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Organic compounds, *Public health, *Volatilization, Lakes, Rivers, Dye releases, Tracers, Theoretical analysis, Sensitivity analysis.

Theoretical analysis, Sensitivity analysis.

Liquid film coefficients of ethylene gas, K sub L, were determined from data on ethylene and rhodamine WT dye concentration distributions collected in shallow streams and rivers located in Southern Ontario. Relationships among the liquid film coefficients, river channel hydraulic characteristics and chemical properties of organic compounds were developed through dimensional analysis using the Buckingham Pi-Theorem. Sensitivity analyses of various parameters on the K sub L were carried out. A statistical relationship developed by Rathbun and Tai (1982) underestimated K sub L values for the Southern Ontario streams and rivers. An evaluation of the theoretical relationships between K sub L and molecular properties (critical volumes and molecular weights) using experimental data from the literature showed that the relationship between K sub L and critical volume is suitable to calculate K sub L values for highly volatile organic chemicals using the known coefficient values of ethylene gas or other compounds such as propane or benzene. For moderate and low volatile compounds, no relationships could be obtained from the available data. The computation of the liquid film coefficient is outlined for a given organic compound. The present method is applicable to volatile compounds with Henry's law constants greater than .001 atm/cu m/mol. (Geiger-PTT) W87-00521

SPATIAL ESTIMATION OF HAZARDOUS WASTE SITE DATA, ERM-Southeast, Inc., Marietta, GA. J. Zirschky, G. P. Keary, R. O. Gilbert, and E. J.

JOEEDU, Vol. 111, No. 6, p 777-789, December 1985. 2 fig, 3 tab, 12 ref.

Descriptors: "Hazardous materials, "Path of pol-lutants, "Dioxin, "Spatial distribution, "Statistical methods, "Kriging, Fluvial sediments, Waste dis-posal, Stream pollution, Waste dumps, Models, Comparison studies, Model studies.

Kriging is a technique which can be used to obtain minimum variance, unbiased estimates of the concentration of a pollutant at a point, or the average concentration in an area or volume. The use of simple and universal kriging for analyzing the distribution of dioxin (2,37,8*TCDD) in the sediments of a creek is demonstrated. The resulting point and block estimates were slightly better than the simple kriging estimates, no clear advantage to using universal kriging was apparent in this exam-

ple. In general, however, universal kriging should be considered whenever a significant drift is present in the data. (Author's abstract) W87-00522

SUSPENDED SEDIMENT . RIVER FLOW

Utah State Univ., Logan. Dept. of Civil and Envi-ronmental Engineering.

N. J. Grenney, and E. Heyse.

Journal of Environmental Engineering (ASCE)

JOEEDU, Vol. 111, No. 6, p 790-803, December

1985. 4 fig. 5 tab, 15 ref.

Descriptors: *Suspended sediments, *River flow, *Path of pollutants, *Probability distribution, Flow profiles, Model studies, Mathematical studies, Sediment transport, Discharge capacity, Statistical

There is an increasing interest in suspended sediment as a water quality parameter because of its potential as a transport mechanism for pollutants and because of its possible effects on fish habitat. The application of bivariate probability distribution functions to represent the suspended sediment concentration-water discharge data for the San Juan River at Bluff, Utah is presented. This approach has several advantages over more traditional methods, including preservation of sediment concentration information and convenience for computer implementation. A bivariate log-normal density function was found to adequately represent the San Juan River data. Average sediment yields were calculated using the closed form solution of the moment generating function, and compared to the results from the flow duration-sediment rating curve method. The bivariate log-normal density function was found to be a convenient, accurate function was found to be a convenient, accurate method for parameterizing the frequency distribu-tion of sediment concentrations and water dis-charges for the San Juan River. (Author's abstract) W87-00523

EFFECTS OF DIFFERENTIATED APPLICA-TIONS OF FERTILIZER N ON LEACHING LOSSES AND DISTRIBUTION OF INORGAN-ICN IN THE SOIL,

Sveriges Lantbruksuniversitet, Uppsala. Dept. of Soil Sciences.

L. Bergstrom, and N. Brink.
Plant and Soil PLSOA2, Vol. 93, No. 3, p 333-345, 1986. 3 tab, 7 fig, 19 ref.

Descriptors: *Nitrogen, *Drainage water, *Groundwater, *Path of pollutants, Soils, Leaching, Fertilization, Rape, Wheat, Sweden.

The effects of increased use of commercial nitro-gen fertilizer on drainage water and groundwater quality were evaluated. The seasonal variation in gen returner to thanage water and gioundwater quality were evaluated. The seasonal variation in the mineral nitrogen content of the soil was determined in order to see the impact of residual N on leaching losses. Nitrogen fertilizer was applied to field plots at rates of 0, 50, 100, 150 and 200 N kg/ha/yr. Water samples, collected monthly or bimonthly from 1974 to 1983, were analyzed for norganic and total N content. Soil samples were collected to a depth of 2 m in the N0, N100 and N200 plots, usually in September and April. Leaching of nitrate was moderate to the N100 level but increased substantially with increasing fertilization, up to 91 N kg/ha/yr for the highest application rate (N200), during the wet year of 1980/81. The losses were greatest during the fall. The N content of the groundwater did not show any significant correlation to the fertilization intensity. A buildup of inorganic N in the soil occured any significant correlation to the fertilization intensity. A buildup of inorganic N in the soil occured only when excessive amounts of fertilizer were applied (N200), while the contents of the N0 and N100 treatments fluctuated around states of balance. Spring rape followed by winter wheat showed a greatg ability to reduce N contents in the tile effluent from highly fertilized plots (N150 and N200), even though the plots had received excessive amounts of fertilizer for several years. Results of this experiment in central Sweden demonstrate the importance of applying nitrogen fertilizer in balance with crop needs and of maintaining a growing crop cover as much of the time as possi-

Group 5B-Sources Of Pollution

ble in order to minimize water pollution. (Alexander-PTT) W87-00550

SUPPRESSION OF NITRATE FORMATION WITHIN AN EXOTIC CONIFER PLANTATION, Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre.

A. B. Cooper.
Plant and Soil PLSOA2, Vol. 93, No. 3, p 383-394, 1986. 2 tab, 5 fig, 21 ref.

Descriptors: *Nitrates, *Watersheds, *Pine trees, *Path of pollutants, New Zealand, Soils, Stream waters, Conifer forests, Pastures.

waters, Conifer forests, Pastures.

Nitrate losses and nitrifier activities of two adjacent watersheds in the Central Volcanic Plateau region of New Zealand were compared. The mechanism of nitrifier suppression in soil beneath pine trees was studied. Nitrate-N losses to stream waters and soil inorganic N pools, nitrifying potentials and NO3-N production rates were measured in 2 adjacent watersheds, one used as pasture and the other planted in exotic conifer forest. Estimated NO3-N loss to stream waters fraining the pine and pasture watersheds were 0.6 kg/ha/yr and 7.6 kg/ha/yr tespectively. Ammonium-N pool sizes were not significantly different between soils in the 2 watersheds but NO3-N pools and nitrifying potentials were always lower in the pine watershed soil samples. Laboratory incubation experiments indicated that suppression of NO3-N formation in pine watershed soils required the presence of live tree roots and was not due to the direct action of allelopathic chemicals on nitrifiers. (Alexander-PTT) PTT) W87-00551

ORGANIC CARBON IN THE CAURA RIVER. Cornell Univ., Ithaca, NY. Ecosystems Research

Center. For primary bibliographic entry see Field 2H. W87-00568

IMPORTANCE OF CONTAMINATED FOOD FOR THE UPTAKE OF HEAVY METALS BY RAINBOW TROUT (SALMO GAIRDNERI): A FIELD STUDY.

Innsbruck Univ. (Austria). Inst. fuer Zoologie. Por primary bibliographic entry see Field 5C. W87-00571

AROMATIC COMPOUND SOLUBILITY IN

AROMATIC COMPOUND SOLUBILITY IN SOLVENT/WATER MIXTURES, Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.

J.-K. Pu, and R. G. Luthy.

Journal of Environmental Engineering (ASCE)

JOEEDU, Vol. 112, No. 2, p 328-345, April 1986.

7 fig. 3 tab, 35 ref. EPA Contract R810878-01.

Descriptors: *Path of pollutants, *Solutes, *Organic solvents, *Industrial wastewaters, *Hazardous wastes, Pollutants, Aromatic solutes, Polar solvents, Log-linear model.

The solubility of various aromatic solutes in misci-ble, polar solvent/water mixtures was investigated ble, polar solvent/water mixtures was investigated through experiment and interpreted through chemical thermodynamic models. Eighteen solute/solvent/water systems were evaluated that represented different properties with respect to hydrogen bonding and functional group substitution. The persistence of appreciable organic solvent in the aqueous phase has a large effect on the solubility of the more hydrophobic solutes. There was a semi-leastiful properties in excessive in each tility with the executive section. logarithmic increase in solubility with increasing solvent volume fraction. The increase in solute solvent volume fraction. The increase in solute solubility with solvent volume fraction could be predicted by several chemical thermodynamic techniques, for which the accuracy improved with the extent of use of experimental data to account for residual effects. The results are useful to understand solute physico-chemical properties in heavily contaminated systems, such as in certain industrial wastewaters or in hazardous wastes containing polar solvent. The log-linear approach was the

most easily applied of the various techniques which were developed to predict solubility. However, application of the log-linear model requires at least two data points, preferably solubility in pure water and solubility in 50% or 100% pure solvent. While aqueous solubility data are commonly available for many aromatic solutes, relatively little information exists on solubility of aromatic compounds in various solvents. (See also W87-00598)

EFFECT OF ORGANIC SOLVENT ON SORP-TION OF AROMATIC SOLUTES ONTO SOILS, Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering. J.-K. Fu, and R. G. Luthy. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 346-366, April 1986. 10 fig, 2 tab, 35 ref. EPA Contract R810878-01.

Descriptors: *Soil absorption capacity, *Path of pollutants, *Aromatic compounds, Polar solvent, Hydropholic solutes, Solubility, Solutes.

The effect of polar solvent in the aqueous phase on the sorption of relatively hydrophobic solutes onto soils was studied. The hydrophobic aromatic solutes generally display a semi-logarithmic increase in solubility with increasing volume fraction of solvent in solvent/water mixtures. This results in a semi-logarithmic decrease in the tendency for these solutes to sorb onto soil. A semi-empirical model is developed which supports these findings. The increase in solute solubility does not result in a directly proportional decrease in the sorption coefficient. The effect of solvent on the increase in solute solubility and the decrease in soil sorption is more pronounced for the more hydrophobic solutes. These findings can be used to assess near-source transport of hydrophobic aromatic solutes in soil systems in the event of a spill or discharge of solutes with a polar solvent. (See also W87-00597) (Peters-PTT)

STREAM MODEL OF BENTHIC NITRIFICA-TION-DENITRIFICATION, Research Triangle Inst., Research Triangle Park,

R. E. Williams, and M. S. Lewis. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 367-386, April 1986. 7 fig, 9 tab, 21 ref, append.

Descriptors: *Water quality, *Model studies, *Dissolved oxygen profile, *Nitrification, *Dentirification, *North Carolina, *Benthic processes, Streeter-Phelps equation, Streams, Shallow streams, Sediment-water interface, North Buffalo Creek, Greensboro, Knap of Reeds Creek, Butner, Nitro-Acceptation

A water quality model based on a modification of the Streeter-Phelps equation was developed to sim-ulate the dissolved oxygen profile in shallow streams. This model assumes that nitrification and denitrification occur simultaneously at or just below the sediment-water interface. Both of these processes are assumed to proceed according to North Buffalo Creek near Greensboro, North Carolina and Knap of Reeds Creek near Butner, North Carolina. Concentrations of water quality constituents calculated using the model water in senseal. cams. This model assumes that nitrification itrification occur simultaneously at or Carolina and Amp of Reces Creek near Bunner, North Carolina. Concentrations of water quality constituents calculated using the model were in general agreement with those measured for both receiving waters. This implies that nitrification and denitrification occur simultaneously in the sediments throughout the affected stream segments. The depth of the receiving waters is important in determining the effect of benthic processes on the nitrogen and dissolved oxygen profiles in streams. In shallow streams, the volume to bottom surface area ratio is small, and the influence of sediment processes on water quality is significant. In deeper streams with greater volume to bottom surface area ratios, benthic processes may not exert as strong an influence on the water column even though the magnitude of the rates may still be similar to those in shallow streams. However, benthic processes may be significant in their effects

on dissolved oxygen in deep, slow-moving streams due to the characteristically lower reaeration rates due to the chara (Peters-PTT) 787-0059

MODELING OF PHYTOPLANKTON IN SAGI-NAW BAY: I. CALIBRATION PHASE,

Environmental Research Lab., Narragansett, RI. V. J. Bierman, and D. M. Dolan. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 400-414, April 1986. 9 fig, 6 tab, 18 ref.

Descriptors: *Phytoplankton, *Model studies, *Phosphorus, *Saginaw Bay, *Lake Huron, Hydrological cycle, Productivity cycle, Seasonal patterns, Sediments, Resuspended sediments, Sediment-water interactions, Water quality models.

A deterministic, spatially segmented, multi-class phytoplankton model is calibrated to an extensive set of field data acquired on Saginaw Bay, Lake Huron, during 1974 and 1975. Significant differ-ences between observed mean values from the field data, and mean values computed by the model, are determined. For the final calibration results, there determined. For the final calibration results, there are no significant differences between model output and field data for 86% of the sampling cruises in the principal spatial segments. Seasonal mean values between model output and field data are also compared because the hydrological and productivity cycles in the bay are characterized by distinct seasonal patterns. Discrepancies occur for water column total phosphorus concentrations because they appear to be strongly influenced by wind induced sediment resuspension. The resuspension mechanism in the .:alibrated model accounts for 36 and 68% respectively, of the computed spring and fall average of total phosphorus concentrations. It is concluded that sediment-water interactions are an important consideration in the concentrations. It is concluded that segment-water interactions are an important consideration in the development and application of water quality models to shallow, highly dynamic systems. (See also W87-00602) (Peters-PTT) W87-00601

MODELING OF PHYTOPLANKTON IN SAGI-NAW BAY: II, POST-AUDIT PHASE, Environmental Research Lab., Narragansett, RI.

V. J. Bierman, and D. M. Dolan. Journal of Environmental Engineering (ASCE) JOEDU, Vol. 112, No. 2, p 415-429, April 1986. 4 fig, 6 tab, 12 ref.

Descriptors: *Phytoplankton, *Model studies, *Phosphorus, *Saginaw Bay, *Lake Huron, Odors, Municipal water, Water quality, Sediments, Resu-spended sediments.

A phytoplankton simulation model was developed and calibrated to an extensive set of baseline data for 1974 and 1975 on Saginaw Bay, Lake Huron. Comparisons are made between a priori model predictions and an extensive set of resurvey data acquired in 1980, subsequent to the implementation of controls on phosphorus loadings. The response of the bay is consistent with trends of model prediction rapes but not with their absolute values in of controls on phosphorus loadings. The response of the bay is consistent with trends of model prediction ranges, but not with their absolute values in all cases. Observations are consistent with the prediction that threshold odor violations in the municipal water supply would be eliminated with total phosphorus tributary loadings that occurred in 1980. Model predictions are consistent with the observations that total phosphorus concentration decreased by a much smaller proportion than the decrease in tributary loadings, and that phytoplankton concentrations, especially blue-greens, decreased by larger proportions than total phosphorus concentrations. The observed differential response between total phosphorus and phytoplankton concentration implies that total phosphorus concentration is not a meaningful water quality indicator in Saginaw Bay. The most critical causative factor in the response of the bay appeared to be the decrease in tributary loadings of available phosphorus. Phosphorus loading to the water column from resuspended sediment was probably not in a form that was available for phytoplankton growth. This conclusion may have similar implications for other lake systems in which sediment resuspension (Peters-PTT) W87-00602 sion is important. (See also W87-00601)

FACTORS AFFECTING THE MINERALIZA-TION OF NITROGEN IN SEWAGE SLUDGE APPLIED TO SOILS, Agricultural Research Service, Beltsville, MD. Soil-Microbial System Lab. For primary bibliographic entry see Field 5E. W87-00603

PHOSPHORUS LOSSES IN RUNOFF AS AF-FECTED BY TILLAGE, Wisconsin Univ-Madison. Dept. of Soil Science. B. J. Andraski, D. H. Mueller, and T. C. Daniel. Soil Science Society of America Journal SSSJD4, Vol. 49, No. 6, p 1523-1527, November-December 1985. 4 tab, 31 ref.

Descriptors: *Water pollution sources, *Phosphorus, *Agricultural runoff, *Water quality control, Tillage, Fertilizer, Corn, Sediments, Conservation, Simulated rainfall.

Simulated rainfall.

Elimination of the surface-applied fertilizer variable and evaluation of the comparative effects of four tillage systems on P loss runoff water under such conditions were studied. Simulated rainfall was used to evaluate the comparative effects of four tillage systems on the losses of total P, dissolved molybdate-reactivity P(DMRP) and algal-available P(AAP) where fertilizer was subsurface banded at planting. Tillage treatments included conventional (CN) and three conservation tillage (CT) systems: chisel plow (CH), till-plant (TP) and no-till (NT). Above-ground portions of corn (Zea mays L.) plants were removed prior to simulation. Trials were conducted over a 4-year period, with individual trials being performed in June and July, September, or October of various years. The NT, CH, and TP treatments reduced total P losses by an average of 81, 70, and 59%, respectively, relative to CN. The sediment fraction was the major carrier of P for all tillage treatments. CT reduced total P concentrations and losses by controlling erosion. When differences in runoff were small, DMRP losses were similar among treatments. The relative percentage of AAP concentrations to total P concentrations increased over the course of the study. The practice of subsurface banding of fertilizer P at planting eliminated this P input to runoff from CT land. Such a method of fertilizer incorporation can be done without incorporating protective crop residues needed for erosion control, and non C1 land. Such a method of fertilizer incorporation can be done without incorporating protective crop residues needed for erosion control, and therefore, may improve the runoff water quality from CT land. (Peters-PTT)
W87-00607

SELECTIVE EROSION OF PLANT NUTRI-

SELECTIVE EROSION OF PLANT NUTRI-ENTS IN RUNOFF, Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab. A. N. Sharpley. Soil Science Society of America Journal SSSJD4, Vol. 49, No. 6, p 1527-1534, November-December 1985. 6 fig, 4 tab, 34 ref.

Descriptors: "Water pollution sources, "Path of pollutants, "Water quality, "Agricultural runoff, "Nutrients, "Soil loss, "Phosphorus, "Nitrogen, Carbon, Potassium, Enrichment ratio, Soil flexibility, Soil productivity, Erosion, Soil physical properties, Soil chemical properties.

In water quality models, estimation of nutrient transport in runoff is limited to sediment total P (TP) and total N (TN) losses. Other relationships developed here between enrichment ratio and soil loss provide nutrient enrichment ratios necessary to estimate the transport of those associated with sediment. The enrichment of several P forms (Bray I, labile, inorganic, and organic), N, C, and K in runoff sediment was investigated for six soils of varying physical and chemical composition, using simulated rainfall (60 and 120 mm/hour). Differing enrichment ratios (ER) for C, N, and organic P (2.00, 1.61, and 1.47 average for the six soils) indicate that erosion may reduce the C/N/organic P ratio of the remaining surface soil. Average ERs,

for Bray I (2.45) and labile P (2.89) were signifi-cantly greater than for the other P forms (1.48). Phosphorus desorption - sorption characteristics, buffer capacity (1.49), sorption index (1.56), equi-librium P concentration (1.80), and exchangeable (2.46) were also enriched in runoff sediment com-pared to source soil. Statistically significant differ-ences between regression equations for each nutri-ent indicate that more than one equation is needed to estimate different nutrient ERs. The potential use of ERs in estimating the effect of erosion on soil fertility is discussed. (Peters-PTT) W87-00608

ATMOSPHERIC MERCURY-A REVIEW, Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Inorganic Chemistry.

(Sweden), 100 (S

Descriptors: *Mercury, *Lake sediments, *Air pollution, *Water pollution sources, *Peat bogs, Precipitation, Sweden, Europe, Smelters, Scandinavia.

Presents knowledge about atmospheric mercury is assessed, including its occurrence in air and precipitation, chemical transformations taking place in the atmosphere, and mercury fluxes to and from the Earth's surface. Tentative budgets are estimated for mercury in the global atmosphere and in the atmosphere over Europe and Sweden. Around a large Swedish smelter, mercury levels in lake sediments are significantly augmented even beyond 50 km from the plant. Measurements of mercury in lake sediments and peat bogs show that in southern Scandinavia, the rate of mercury deposition has increased by a factor of about 5 during the last hundred years. (Peters-PTT) W87-00614

OCCURRENCE OF SULFATE-RICH RAINS IN OCCURRENCE OF SULFATE-RICH RAINS IN THE NEGEV DESERT, ISRAEL, Ben-Gurion Univ. of the Negev, Sde Boker (Israel), Jacob Blaustein Inst. for Desert Research. R. Nativ, A. Zangvil, A. Issar, and A. Karnieli. Tellus TELLAL, Vol. 37B, No. 3, p 166-172, July 1985. 3 fig. 2 tab, 7 ref.

Descriptors: *Rainfall, *Sulfates, *Calcium, *Negev Desert, *Israel, Isotropy, Chemical properties, Mediterranean, Chemistry of precipitation.

erties, Mediterranean, Chemistry of precipitation. Rain water was sampled in the Negev Desert, Israel for the past six years. Events with relatively high amounts of sulfate were detected and studied for their chemical, isotopic and synoptic features. The sampling of rain water was facilitated through the development of sequential self-sealing special samplers. Sixty rain events were sampled and analyzed for their chemical composition. Out of 20 cases of sulfate-rich rain events, only 11 contributed more than one sample (i.e., more than the first 2 mm or rain fall) for sulfate analysis. Sulfate rich water is usually encountered at the beginning of a rain event. Only 45% of the rain events included sulfate water in the second 2 mm. The rest were changed eventually to the more common type of CaHCO3 or CaCl2 water. A typical sulfate-rich rain occurrence in mid-winter, can be characterized as a surface low centered over the eastern Mediterranean, accompanied by an upper trough whose axis extends from north to south or from northwest to southeast. (Peters-PTT)

TRANSVERSE DISPERSION FROM AN ORIGINALLY SHARP FRESH-SALT INTER-FACE CAUSED BY SHEAR FLOW,
Technische Hogeschool Delft (Netherlands).
For primary bibliographic entry see Field 2F. W87-00634

DISTRIBUTION AND ACCUMULATION OF METHYLCYCLOPENTADIENYI. MANGANESE TRICARBONYI. (MMT-ANTIDETONATING AGENT) IN AN EXPERIMENTAL FRESHWATER ECOSYSTEM, (REPARTITION ET ACCUMULATION DU METHYLCYCLOPENTA-

Sources Of Pollution-Group 5B

DIENYL MANGANESE TRICARBONYL (MMT-AGENT ANTIDETONANT) DANS UN ECOSYSTEME D'EAU DOUCE EXPERIMEN-TAL)

TALJ, CEA Centre d'Etudes Nucleaires de Grenoble (France). Dept. de Recherche Fondamentale. J. P. Garrec, and A. Kudo. Environmental Pollution (Series B) EPSPDH, Vol. 10, No. 3, p 173-188, 1985. 3 fig, 11 tab, 8 ref.

Descriptors: *Organic compounds, *Manganese, *Path of pollutants, *Methylcyclopentadienyl manganese tricarbonyl, *Sediments, Ecology, Ecosystems, Freshwater, Fish, Planta.

The environmental consequences of the use of MMT (methylcyclopentadienyl manganese tricarbonyl) on the different components of an experimental freshwater ecosystem have been studied by following the evolution of their manganese concentrations. The results have been compared with those obtained with inorganic manganese in the same experimental conditions. In the sediments, the same proportion but the accumulation of MMT is located only at the surface. On the other hand, in living organisms (plants, fish), the accumulation of MMT is, compared with that of Mn(I), nearly ten times higher. The accumulation of MMT, as well as that of Mn(I), are strongly dependent on whether the medium is stirred or not. (Author's abstract) W87-00652

POLLUTION RECONNAISSANCE IN STREAM SEDIMENTS USING NON-RESIDUAL TRACE

METALS,
Liverpool Univ. (England). Dept. of Oceanogra-

phy. For primary W87-00653 ary bibliographic entry see Field 5A.

INFLUENCE OF BIOTURBATION ON PHYSICAL, CHEMICAL AND BIOLOGICAL PARAMETERS IN AQUATIC ENVIRONMENTS: A

Toronto Univ. (Ontario). Inst. for Environmental

G. Krantzberg. Environmental Pollution (Series A) EPEBD7, Vol. 39, No. 2, p 99-122, October 1985. 117 ref.

Descriptors: *Biotransformation, *Biodegradation, *Path of pollutants, *Bioturbation, Ecosystems, *Aquatic environment, *Benthic fauna, Biological properties, Invertebrates, Sediments, Metals, Pollutants, Reviews.

The role of benthic macroinvertebrates in sediment processing is of importance for investigators at-tempting to describe the dynamics of a wide range of materials in aquatic environments. Benthic matempting to describe the dynamics of a wide range of materials in aquatic environments. Benthic macroinvertebrates have been shown to blur sediment stratigraphy, alter particle size and pore spaces, and influence shear strength of the sediment and turbidity of overlying waters. The macroinfauna can increase oxygen and E sub h penetration into the sediment and shift pH levels in actively worked substrates. These changes have been correlated with trace element redistributions among physicochemical forms and the flux of N, P, PCBs, Cu, Fe, L Hz, Mn, Si, Zn, and radioisotopes to the water I, Hg, Mn, Si, Zn and radioisotopes to the water column. It has been said that bioturbation can stimulate microbial activity, although the data remain inconclusive. Realistic estimates of sediremain inconclusive. Reasistic estimates of sedi-ment partical mixing rates are required in order to estimate the impact of bioturbation on core dating techniques, material cycling studies and contam-nant remobilization from polluted spoils. (Author's abstract) W87-00654

MACROBENTHIC INVERTEBRATES OF A STREAM FLOWING THROUGH FARMLANDS IN SOUTHERN NIGERIA, Benin Univ., Benin City (Nigeria). Dept. of Zoolo-

gy. R. Victor, and A. E. Ogbeibu. Environmental Pollution (Series A) EPEBD7,

Group 5B—Sources Of Pollution

Vol. 39, No. 4, p 337-349, December 1985. 2 fig. 3

Descriptors: *Invertebrates, *Benthic, Fauna, *Biotypes, *Limmology, Macroinvertebrates, Ecosystems, Ecology, *Nigeris, Rural areas, Urban areas, Species diversity.

Macrobenthic invertebrates of a fourth order steam flowing through farmlands in Southern Nigeria were studied. Fifty-five taxa, comprising a total of 9008 individuals were collected. Chironomidae, Naididae and Baetidae were the major components Naididae and Bactidae were the major components of the benthic community. In spite of the overall faunal similarity, the distribution and abundance of macroinvertebrate taxa richness, general diversity and evenness indices calculated for these biotopes were also different. The benthic diversity by urban activities. It is, however, lower than that indicative of a physically controlled ecosystem. (Author's instruction) abstract) W87-00662

MIXED CULTURE BIOLOGICAL ACTIVITY IN WATER CONTAINING LOW CONCENTRA-TIONS OF CYANIDE, PHENOL AND BOD, Yarmouk Univ., Irbid (Jordan). Dept. of Civil En-

gineering.
A. M. Shahalam, and A. R. Mansour.
Environmental Pollution (Series A) EPEBD7,
Vol. 39, No. 4, p 351-371, December 1985. 5 fig. 5 tab, 24 ref.

Descriptors: *Biodegradation, *Cyanide, *Phenol, *Glucose, *Biological oxygen demand, Organic carbon, Degradation, Industrial wastes.

A laboratory-scale study was performed to determine the biodegradability of glucose in the presence of cyanide and phenol. The concentration of chemicals was maintained at a low level which Chemicals was manually at a law active values would normally be experienced in natural streams receiving industrial wastes. A continuosly fed, complete-mix reactor was utilized. The system was totally closed and included traps to separate volatilized cyanide from the products resulting from hydrolysis. For several steady-state conditions the influent and effluent water multiply with respect to hydrolysis. For several steady-state conditions the influent and effluent water quality with respect to micro-organism, glucose, cyanide, phenol, ammonia, and total nitrogen concentation was determined. Influent waste quality varied (i.e., different concentrations of feed chemicals) for different steady-states. Biological degradation kinetics for total organic carbon, cyanide, and phenol were developed. The rates were found to be related to developed. The rates were found to be related to temperature and the concentration of the different chemicals in the solution. The results indicated that statistically developed relationships for the biode-gradation of glucose, cyanide and phenol can ade-quately represent the degradation rates at low con-centrations of cyanide and phenol (cyanide < 4.00 mg/liter and phenol < 1.40 mg/liter). (Author's abstract) abstract) W87-00663

EFFECT OF DECAYING LEAVES ON THE PH AND BUFFER CAPACITY OF WATERS, Louisiana State Univ., Baton Rouge. Dept. of Chemistry. For primary bibliographic entry see Field 5C. W87-00677

EFFECT OF BIODEGRADATION ON THE DE-TERMINATION OF SOME CHEMODYNAMIC PROPERTIES OF PHTHALATE ESTERS, State Univ. of New York at Binghamton. Dept. of

Chemistry.

D. J. Russell, B. McDuffle, and S. Fineberg.

Journal of Environmental Science and Health (A)

JESEDU, Vol. 20, No. 8, p 927-941, 1985. 2 fig, 3

tab, 27 ref. BRSG Grant SO7RR07149-8.

Descriptors: *Phthalate esters, *Chemodynamic properties, *Biodegradation, *Soils, Degradation, Organic compounds, Water pollution, Fate of pol-

Phthalate esters (PEs) are a class of organic com-pounds widely used as plasticizers. As they have been found in soils, sediments and water, there is

concern for the effects of PEs on aquatic organisms and for possible human health effects including the reported carcinogenicity of di-(2-ethyl-hexyl) phthalate. Initial efforts to determine chemodynamic properties of three PEs in soil-water systems gave erratic results. This behaviour can be explained by the occurrence of biodegradation of PEs over time scales encountered in laboratory investigations. Phthalate esters, as a class of organic pollutants, exhibit a wide range of chemodynamic properties which, if known with more accuracy, might be used to predict the transport and ultimate fate of PEs in the environment. Data presented shows that three of the lower molecular weight PEs are susceptible to biodegradation in soil-water systems. These data not only support evidence that biodegradation may be important with respect to environmental fate, but show that caution must be undertaken to avoid errors in caution must be undertaken to avoid errors in caution must be undertaken to avoid errors in equilibrium laboratory experiments such as Kp de-terminations and soil mobility studies. In additon, it has been shown the Kp values for PEs obtained by dynamic soil column experiments are in agreement with equilibrium values. Further PE migration ex-periments under sterile conditions have confirmed periments under sterile this. (Khumbatta-PTT) W87-00678

EFFECTS OF PH UPON THE ENVIRONMENTAL FATE OF (14C)FENTROTHION IN AN AQUATIC MICROCOSM,
Ohio State Univ., Columbus. Dept. of Entomolo-

Ecotoxicology and Environmental Safety EESADV, Vol. 10, No. 1, p 53-62, August 1985. 2 fig, 7 tab, 12 ref.

Descriptors: *Pesticides, *Fate of pollutants, *Fen-itrothion, *Hydrogen ion concentration, Heavy carbon, Isotope studies, Stable isotopes, Pesticides,

The residence time of pesticides in water determined by numerous physical factors, a compound's rate of degradation would be affected by water hardness, incident light and temperature and most importantly, the pH of the water. A large number of pesticides are esters whose primary mode of degradation is hydrolysis of the ester bond; since the rate of hydrolysis is a function of pH, the pH of the water would influence the stability of such esters. The environmental fate of (14C)fenitrothion was evaluated in aquatic microcosms held at pH 8.3 or 6.7. No general effect attributable to pH was observed. However, statistically higher amounts of radioactivity were present in water held at pH of observed. However, statistically higher amounts of radioactivity were present in water held at pH of 6.7 and significantly less metabolism of the parent compound occurred in the organisms at pH 8.3. The differences in metabolism and environmental fate between pH values are relatively minor and do not compromise the safety of the compound. (Khumbatta-PTT) W87-00683

SEPTIC TANK DENSITY AND GROUND-WATER CONTAMINATION, ital Research Lab., Robert S. Kerr Environm

Ground Water GRWAAP, Vol. 23, No.5, p 586-591, September-October 1985. 3 tab, 32 ref.

Descriptors: *Groundwater pollution, *Path of pollutants, *Septic tank density, *Septic wastewater, *Human diseases, Subsurface water,

The public has become increasingly aware of the importance of preserving the quality of ground-water as more and more cases of ground-water contamination are reported. The majority of water-borne disease outbreaks are caused by bacteria and viruses present in domestic sewage. Septic tanks contribute the largest volume of wastewater, 800 billion gallons per year to the subsurface and are most commonly reported for groundwater contamination. The U.S. Environmental Protection Agency has designated areas with sentic tank den-Agency has designated areas with septic tank densities of greater than 40 systems/sq mile as regions of potential ground-water contamination. Numer-

ous cases of groundwater contamination have been reported in these areas of high septic tank density. The most important means of limiting groundwater contamination by septic tanks is to restrict the density of these systems in an area. (Author's ab-

STABLE CARBON ISOTOPES OF HCO3(-) IN THE AQUIA AQUIFER, MARYLAND: EVIDENCE FOR AN ISOTOPICALLY HEAVY SOURCE OF CO2,

Geological Survey, Towson, MD. F. H. Chapelle, and L. L. Knobel. Ground Water GRWAAP, Vol. 23, No. 5, p 592-599, September-October 1985. 4 fig. 2 tab, 14 ref.

Descriptors: *Stable isotopes, *Aquia aquifer, *Carbon Isotopes, *Aquifers, Isotope studies, Isotope fractionation, Carbon radioisotopes, Carbon-14, Carbon dioxide, Methane bacteria.

Concentrations of HCO3(-) and delta 13-C values of dissolved inorganic carbon change along the hydrologic gradient of the Aquia aquifer. Meteoric recharge in the outcrop area rapidly dissolves carbonate shell material in the presence of soil-gas CO2. Concentrations of HCO3(-) are said to CO2. Concentrations of HCO3(-) are said to gradually decrease as water flows away from the outcrop area. These trends reflect progressive dissolution of metastable carbonate shell material and subsequent precipitation of secondary calcite cement. At about 40 miles downgradient in the flow system, the HCO3(-) concentrations increase sharply. The Na(+):HCO3(-) ratio demonstrates that shell material dissolution must take place in the presence of CO2. The possible sources of aquier-generated CO2 include bacterially-mediated fermentation of lignitic aquifer materials and bacterially-mediated methanogenesis. (Khumbatta-PTT) PTT) W87-00685

GROUND-WATER MODEL OF TWO-PHASE IMMISCIBLE FLOW IN COARSE MATERIAL, Resource Consultants, Inc., Fort Collins, CO.

Resource Constants, site, p. 10. P. Hochmuth, and D. K. Sunada. Ground Water GRWAAP, Vol. 23, No. 5, p 617-626, September-Ociober 1985. 9 fig, 3 tab, 20 ref.

Descriptors: *Multiphase flow, *Groundwater pol-lution, *Path of pollutants, *Immiscible flow, Coarse material, Groundwater models, Water pol-lution, Hydraulic models, Finite-element method, Organic compounds, Aquifers, Oil spills, Hydro-

One of the major threats to high-quality ground-water resources is the widespread occurrence of contamination due to spills and leaks of organic materials such as petroleum products which occur during their transport, storage and disposal. A numerical model was developed to simulate the behavior of two-phase immiscible fluids in ground-water systems for specific application to hydrocarbon spills and leaks. The model was a two-dimensional areal flow model using the finite-element method. A verification of the numerical model was performed using both an approximate analytical solution and a laboratory investigation. The numerical model simulated the areal distribution of il and water in a groundwater aquifer for coarsemerical model simulated the areal distribution or oil and water in a groundwater aquifer for coarse-grained uniform-sized porous media. For fine-grained media, the effects of capillary pressure distribution between the fluids became significant and a three-dimensional model was needed. atta-PTT)

PRECIPITATION CHEMISTRY AND CHEMI-CAL LIMNOLOGY OF FERTILIZED AND NATURAL LAKES AT SAQVAQJUAC, N. W. T., Department of Fisheries and Oceans, Win (Manitoba). Freshwater Inst.

(Manintols). Fleshwater Inst.
H. E. Welch, and J. A. Legault.
Canadian Journal of Fisheries and Aquatic Sciences CJFSBX, Vol. 43, No. 6, p 1104-1134, June 1986. 20 fig. 20 tab, 40 ref.

Sources Of Pollution—Group 5B

Descriptors: *Acid rain, *Chemistry of precipitation, *Precipitation, *Limnology, Saqvaqiuac, Northwest territories, Sulfates, Ions, Pollutants.

Precipitation at Saqvaqiuac (northwest coast of Hudson Bay, 60 deg 39 min N) had high concentrations of sea salts, was moderately acidic, and had less SO4 and total N than lower latitude precipitation, although SO4 sources were distant. Watershed retention was high for H(+), but negative for other elements as a consequence of isostatic rebound. Yearly element runoff was a function of the timing of melt runoff and summer rain events because of permafrost. Lake retention of Si was higher than P because of the different times of loading, late summer versus spring. Conservative element mass did not change overwinter except in low-elevation Spring Lake, where residual Cl, Na, and K diffused from the sediments. Phosphorus and N were the only elements incorporated into black ice. As a result of freezeout and incomplete meltwater mixing beneath lake ice, element concentrations were 1.6 times higher in lakes than inflows, and major ion turnover times were 1.5 - 2.0 times higher than water turnover times. (Author's abstract)

PHOSPHORUS RELEASE PROCESSES IN NEARSHORE SOUTHERN LAKE MICHIGAN, National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.

uon, Am Arboy, Mr. Oreat Lakes Environmental Research Lab. M. A. Quigly, and J. A. Robbins. Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 43, No. 6, p 1201-1207, June 1986. 7 fig, 2 tab, 45 ref.

Descriptors: *Phosphorus, *Lakes, *Limnology, *Lake Michigan, Phosphorus removal, Soluble reactive phosphorus, Intersitial water, Sediments, Mathematical analysis, Path of pollutants, Oxygen.

Mathematical analysis, Path of pollutants, Oxygen. Soluble reactive phosphorus (SRP) release rates were determined from intact, medium-fine sand cores obtained from an 11-m-deep sampling site in nearshore Lake Michigan during July-October 1980. Mean SRP release ranged from 0.17 + or - 0.03 (SE) to 0.57 + or - 0.04 mg PO-4-P/aq m/d. Pore water analysis indicated that, despite high dissolved oxygen concentrations in the uppermost 6 cm of sediment, SRP concentrations increased rapidly with depth throughout this zone. A Fickian diffusion equation based on the SRP pore water gradient and physical sediment features predicted a release rate (1.12 mg PO-4-P/m/d) that was 2-7 times higher than release rates measured from intact cores. Results suggest that nearshore sediments provide a ready pathway for the return of SRP to overlying water, and this process warrants inclusion in future conceptual models of Lake Michigan's phosphorus cycle. (Author's abstract) W87-00699

CARBON FLOW IN A TUNDRA STREAM ECO-

SYSTEM, Marine Biological Lab., Woods Hole, MA. Ecosystems Center.

systems Center.

B. J. Peterson, J. E. Hobbie, and T. L. Corliss.

Canadian Journal of Fisheries and Aquatic Science

CJFSBX, Vol. 43, No. 6, p 1259-1270, June 1986. 4

fig, 8 tab, 44 ref. NSF-Polar Programs Grant DPP

77-23879.

Descriptors: *Organic carbon, *Kuparuk River, *Productivity, *Cycling nutrients, Arctic zone, Tundra, Streams, Ecosystems, Organic matter, Particulate matter, Aquatic productivity, Algae, Alaska, Carbon.

The carbon cycle of the Kuparuk River, a mean-dering tundra stream, is dominated by inputs of eroding peat and leaching dissolved organic carbon from the tundra. Net production of epilithic algae is about 13 g C/sq m/yr, an order of magnitude less than inputs of allochthonous particulate organic carbon and two orders of magnitude less than inputs of dissolved organic carbon. The streamwater has a mean total organic carbon concentration of 6.8 mg/L, and the annual export of organic carbon from the watershed is 2-3 t/sq km/

yr. Both are similar to the average for temperate streams. Because of the low primary productivity of tundra vegetation, the export of organic carbon from the watershed via the river is a larger fraction (2-6%) of the total watershed net primary production than the 0.1-0.4% usually found for temperate rivers. (Author's abstract)

BENTHIC BACTERIAL BIOMASS AND PRO-DUCTION IN TWO BLACKWATER RIVERS, Georgia Univ., Athens. Inst. of Ecology. S. Findlay, J. L. Meyer, and R. Risley. Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 43, No. 6, p 1271-1276, June 1986. 5 fig. 2 tab, 34 ref. NSF Grant DEB 810-4427.

Descriptors: *Biomass, *Benthic flora, *Bacteria, *Productivity, Aquatic productivity, Aquatic plants, Aquatic life, Blackwater rivers, Carbon.

Bacterial biomass and production in sediments of two blackwater rivers were measured via epifluorescent direct counts and rates of thymidine incorporation into DNA. Biomass ranged from 3 to 1500 mg C/sq m and production ranged from 0.01 to 22.0 mg C/sq m/h. Both biomass and production were correlated with the organic content of the sediment. Neither biomass nor production was temperature related. Allochthonous detritus apparently serves as a growth substrate for sediment bacteria. Despite differences in water chemistry and flow between the two rivers, comparison of similar sites between rivers showed similar bacterial standing stock and production. During most of the year these fourth- and sixth-order rivers are highly heterotrophic, yet at low water autochthonous carbon may serve as growth substrates for bacteria. (Author's abstract)

DIRECT AND INDIRECT EFFECTS OF LOW PH ON THE TRANSFORMATION OF DETRI-TAL ENERGY BY THE SHREDDING CADDISFLY, CLISTORONIA MAGNIFICA (BANKS) (LIMNEPHILIDAE), Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences. For primary bibliographic entry see Field 5C. W87-00705

TRACE METAL UPTAKE AND SODIUM REG-ULATION IN GAMMARUS MARINUS FROM METAL POLLUTED ESTUARIES IN ENG-

Maryland Univ., Solomons. Chesapeake Biological

Lab.
D. A. Wright.
Marine Biological Association of the United Kingdom Journal JMBAAK, Vol. 66, No. 1, p 83-92,
February, 1986. 4 fig, 1 tab, 19 ref.

Descriptors: *Path of pollutants, *Water pollution effects, *Trace metals, *Estuaries, Trace elements, Gammarus, Sodium, Pollution, England, Zinc, Copper, Lead, Seawater, Crustaceans, Aquatic animals.

mals.

Zinc, copper and lead uptake from 1 mg/L solutions of metal in sea water by four populations of Marinogammarus marinus (Leach) was followed over a two week period. The populations tested were from three rivers in SW England having a history of trace metal contamination; Gannel, Hayle and Restronguet Creek. The fourth population sampled was from an uncontaminated river in NE England; River Coquet. For all metals, the Restronguet Creek population had the highest initial concentration and the Coquet population, the lowest initial concentration. For zinc, Coquet animals were the only group to show significant uptake over the two week period and also had the highest rate of uptake of the other two metals, resulting in the highest final copper and lead concentration of any group. The effect of 1 mg Pb/L and 1 mg Cu/L on sodium regulatory ability was tested on the four populations. Animals were exposed for one week to a range of sea-water concentrations between ca. 25-125% sea water. Hyperionic sodium regulation was normal in Coquet

and Gannel populations. Sodium regulation in metal-exposed animals from the River Hayle was erratic at low salinities, although high mortalities renderd these results questionable. Lead exposure in Restronguet animals caused a significant lowering of haemolymph sodium at 25% sea water. There was no consistent relationship between historical metal exposure in M. marinus and the sensitivity of sodium regulation to trace metals. (Author's abstract) W87-00710

TRANSMISSION OF SCHISTOSOMA HAEMA-TOBIUM IN NORTH GEZIRA, SUDAN, Institute for Tropical Medicine, Khartoum (Sudan). Schistosomissis Research Project. S. M. Babiker, H. D. Blankespoor, M. Wassila, A. Fenwick, and A. A. Daffalla. Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 65-73, April 1985. 5 fig. 5 tab, 8 ref. Edna McConnell Clark Foundation Grant 282-0148, NIH Grant AI-16312.

Descriptors: *Sudan, *Schistosomiasis, *Epidemiology, *Gezira, Snails, Molluska, Canals, Irrigation canals, Public health, Path of pollutants.

canals, Public health, Path of pollutants.

During a 14-month study, 128,765 Bulinus truncatus snails were collected from canals near four villages in the northern part of the Gezira Irrigated Area, and were examined for patent trematode infections. In all, 903 shedded cercarise, of which 424 were identified as S. haematobium; one village, Bashagra, was the source of 80% of these infections. The highest density of snails occurred from March to May, and the peak of snail infections occurred from June through August. Residents of the four villages were examined for infection with S. mansoni and/or S. haematobium by collecting and examining stool and urine samples. The overall prevalences were 50% for S. mansoni and 20% for S. haematobium. The age prevalence curves were very different, with S. haematobium falling off more sharply in the over-20 age groups than was the case with S. mansoni. Observations at the human water contact sites suggested that the transmission of S. haematobium was increased when the canals contained shallow stagnant water, when the temperature was above 26 C, and when the site was frequented by small children for swimming. The data suggest that at any site the transmission period is abort and seasonal. (Author's abstract) W87-00714

COMPOSITIONAL CHANGE OF ORGANIC MATTER IN RAINWATER DURING PRECIPITATION EVENTS,

California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics. For primary bibliographic entry see Field 2K. W87-00726

SOLUBILITY OF AMMONIA IN LIQUID WATER AND GENERATION OF TRACE LEVELS OF STANDARD GASEOUS AMMONIA, For primary bibliographic entry see Field 5A. W87-0727

TRACE METAL RESIDUES IN FINFISH FROM MARYLAND WATERS, 1978 - 1979, Maryland Dept. of Health and Mental Hygiene, Baltimore. Office of Environmental Programs. M. Eisenberg, and J. J. Topping.
Journal of Environmental Science & Health (B) JPFCD2, Vol. 21, No. 1, p 87-102, Febuary 1986. 5 tab, 17 ref.

Descriptors: "Path of pollutants, "Fish, "Trace metals, "Maryland, "Chesapeake Bay, "Tissue analysis, Metals, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Zinc, Pollution, Heavy

Levels of seven heavy metal residues (arsenic, cadmium, chromium, copper, lead, mercury and zinc) were monitored in samples of various species of finfish harvested from the Maryland section of

Group 5B-Sources Of Pollution

the Chesapeake Bay and its tributaries over a two year period (1978-79). Samples of finfish gonad and liver tissue were analyzed to study the relative level of preconcentration of heavy metals in these tissues compared to the edible (flesh) portion. Copper and zinc were shown to accumulate higher concentrations in gonad tissue versus flesh. The reverse was true for mercury and cadmium. No significant difference was found for arsenic, chromium and lead. Cadmium, copper and zinc concentrations in liver tissue were significantly higher than corresponding concentrations in the flesh tissue while the reverse was true for mercury. No significant difference was found for arsenic, chromium and lead, as in gonad tissue. (Lantz-PTT) W8T-00730

IDENTIFICATION OF O, O-DIALKYL-S-METHYLPHOSPHORODITHIOATE RESI-Pood and Drug Administration, Washington, DC. Div. of Chemical Technology. For primary bibliographic entry see Field 5A. W87-00734 DUES IN FISH.

TOXIC SCREENING MODELS FOR WATER Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, W. M. Grayman, and J. A. Goodrich. Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 149-165, April 1986. 8 fig. 6 tab, 11 ref.

Descriptors: "Toxicity, "Model studies, "Water supply, "Water pollution sources, Ohio River, Water supply systems, Water quality control, Drinking water, Surface water, Carcinogens, Toxins, Mississippi River, Nonpoint pollution

Many water utilities in the United States depend Many water utilities in the United States depend upon surface water as their primary source of drinking water. Toxic screening models can be used to provide a means for identifying and assessing the pollutants likely to be in water utility source water from point and nonpoint upstream dischargers. Two case studies are presented to evaluate this concept. One is based on the stretch of Ohio River between the Kanawha River and Cincinnati, OH and ranks the vulnerability of the utilities along this stream segment to organoleptic. utilities along this stream segment to organoleptic, toxic, and carcinogenic pollutants. The second case study uses the lower Mississippi to illustrate the use study uses the lower Mississippi to illustrate the use of flow routing models to predict the concentration of contaminants at downstream utilities, based on upstream industrial discharges. The interaction between time of passage and disappearance coefficient of the pollutant is illustrated. (Author's abstract) stract) W87-00745

AGEING OF BLEACHED KRAFT MILL EF-FLUENT STUDIED BY DEGRADATION OF CHLORINATED PHENOLIC COMPOUNDS AND SELENASTRUM ALGAL ASSAYS, Jyvaeskylae Univ. (Finland). Dept. of Biology. K. Kuivasniemi, V. Eloranta, and L. Halttunen-Keyrilainen.

Environmental Pollution (Series A) EPEBD7, Vol. 41, No. 3, p 247-262, 1986. 2 fig, 4 tab, 31 ref.

Descriptors: *Kraft mills, *Effluents, *Bleaching wastes, *Fate of pollutants, *Phenols, Mills, *Pulp wastes, Pulp and paper industry, Aging, Industrial wastes, Organic compounds, Toxicity, Bioassay,

Bleached kraft mill effluent (BKME) from a Finnish kraft pulp mill with a full bleaching system was aged under laboratory conditions. The aging solutions were prepared in nutrient solution and three types of lake water. The changes in acute toxicity of the BKME were studied by Selenastrum algal sasays and degradation of chlorinated phenolics. Chlorinated phenolic compounds were analyzed by gas chromatography from the subsamples taken from the aging solutions on the following days: 0, 4, and 7 or 8. The toxicity of the aging solutions was bioassayed on the same days using Selenastrum capricornutum. The response of the test algae Bleached kraft mill effluent (BKME) from a Finn-

to aging solutions was measured by cell counting after 72 and 96 hours. During the aging period, the amounts of chlorinated phenolics decreased in the following order: (1) chlorocatechols, (2) chlorophenols, and (3) chloroguaiscols. After the aging period, the EC50 values of BKME aging solutions to Selenastrum algae ranged from 6% to 10% by volume, depending on the test medium and the effluent sample used. The correlation between the EC50 values and total chlorinated phenolics was not statistically significant, so it seemed that chlorinated phenolics were not the primary reason for the acute toxicity of the BKME to Selenastrum algae. (Author's abstract)

PALAEOLIMNOLOGICAL AND LIMNOGEO-CHEMICAL FRATURES IN THE SEDIMENTA-RY RECORD OF THE POLLUTED LAKE LIP-PAJARVI IN SOUTHERN FINLAND, Helsinki Univ. (Finland). Dept. of Geology. A. Vuorinen, P. Albonen, and J. Suksi. Environmental Pollution (Series A) EPEBD7, Vol. 41, No. 4, p 323-362, 1986. 22 fig, 2 tab, 123

Descriptora: *Paleolimnology, *Limnology, *Geochemistry, *Lab- Lippajarvi, *Finland, *Sedimentology, Lake, Sediments, Stratigraphy, Eutrophication, Ecosystems, Diatoms, Sedimentation rates, Calcium, Managanese, Zinc, Iron, Copper, Heavy metals, Fate of pollutants.

Investigation of a sediment core from Lake Lippa-jarvi, Finland indicates that increasing eutrophica-tion is the main factor controlling fluctuations in lake ecosystems. There has been an increase in sedimentation rate in the upper part of the lithostratigraphy of the lake, and the increased nutrient load and heavy metal input have led to cultural eutrophication and pollution effects, with signs of eutrophication and pollution effects, with signs of oxygen deficit in the hypolimnion. The eutrophication is accompanied by biogeochemical cycles and limnogeochemical processes apparently responsible for the leaching of chemical elements from sediments, and their subsequent redeposition in more loosely bound forms. Fe has been redeposited mainly as oxyhydroxides and monosulfides, and Cu and Zn also seem to be associated with these precipitates. Ca, Mn, and Zn are present, to relatively large degrees as very loosely bound and sorbed forms. Fe, Mn, Cu, and Zn are also associated with sulfides, and Fe and Cu with biogenic matter. There is a clear difference between manmade airborne forms of Pb and natural mineral-bound forms in the sediment column. In the polluted part, Pb is mainly present in loosely bound ed part, Pb is mainly present in loosely bound reducible forms. Al and Si seem to show leaching and redeposition in the sediments. (Doria-PTT) W87-00770

HYDROGEOCHEMISTRY, CONTAMINANT TRANSPORT AND TECTONIC EFFECTS IN THE OKPOSI-UBURU SALT LAKE AREA OF THE OKPUSI-IBBRU SALT LAKE AREA OF IMO STATE, NIGERIA, Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Earth Sciences. B. C. E. Egboka, and K. O. Uma. Hydrological Sciences Journal HSJODN, Vol. 31, No. 2, p 205-221, June 1986. 9 fig, 2 tab, 20 ref.

Descriptors: *Saline lakes, *Geohydrology, *Hydrology, *Geochemistry, *Fate of pollutants, *Tectonics, *Nigeria, Groundwater movement, Subsurface water, Tritium, Radioactive isotopes, Calcium, Magnesium, Manganese, Sulphates, Chlorides, *Path of pollutants.

Concentrations of dissolved geochemical constituents such as calcium, manganese, magnesium, chloride and sulphate ions, in 35 groundwater samples from the Okposi-Uburu salt lake area show significant areal variations. Dissolved solids, chloride, and manganese ions have concentrations up to and above the objectionable limits for drinking water in the salt lake area. Concentrations of dissolved solids in this zone are about 1200 mg per liter. Concentrations of chloride and manganese ions are 350 mg per liter and 1.0 mg per liter, respectively. These geochemical constituents and groundwater flow patterns show that transport of contaminants Concentrations of dissolved geochemical constitu-

away from the source zone has been greatly influenced by advection while, in areas of high velocity, dispersion is the controlling factor. Temperatures for the Okposi and Uburu salt springs are 34.4 and 37.5 C, respectively. Bomb tritium indicated water of pre-1933 age. Deuterium and oxygen-18 showed high isotopic enrichment. The high concentrations of dissolved salts resulted from the combined effects of migration of dissolved salts through fractures at the lake floor and evaporation from the lake surface. These findings are related to the tectonic history of the Okposi-Uburu area. (Author's abstract) W87-00775

RADIOACTIVITY IN SILT FROM THE RIVER LEA, ENGLAND, North East London Polytechnic (England). Dept. of Physical Sciences. For primary bibliographic entry see Field 5A.

CHEMICAL CHANGES OF ORGANIC COM-POUNDS IN CHLORINATED WATER: X. FOR-MATION OF POLYCHLORINATED METHYL-PHENOXYMETHYLPHENOLS (PREDIOXINS) DURING CHLORINATION OF METHYL-PHENOLS IN DILUTE AQUEOUS SOLUTION, Tokyo Univ. (Japan). Faculty of Pharmaceutical

S. Onodera, K. Yamada, Y. Yamaji, S. Ishikura, and S. Suzuki.

Journal of Chromatography JOCRAM, Vol. 354, p 293-303, February 28, 1986. 7 fig, 2 tab, 15 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Chlorination, *Organic compounds, *Phenols, *Predioxins, Gas chromatography, Chromatography, Mass spectrometry, Chemical analysis, Water analysis, Water treatment, Dioxins, Wastewater treatment.

Aqueous methylphenol solutions (o-, m-, and p-isomers) were treated with hypochlorite at 20 C under various experimental conditions. Changes in the compositions of the chlorination products in water were determined by using gas chromatographic (GC) and gas chromatographic-mass spectrometric (GC-MS) analyses of diethyl ether extracts. The chlorination of methylphenols in dilute aqueous solutions produced a series of highly chlorinated compounds, including chloromethylphenols, chloromethylphenologuinones, and chlorinated carboxylic acids. Tentative identifications also were made for other compounds with following molecular formulae: C14H5C12O2, C14H4C13O2, and C14H3C14O2. On the basis of the thin-layer chromatographic and GC behavior and mass fragmentation patterns, these compounds are considered to matographic and GC behavior and mass fragmentation patterns, these compounds are considered to be chlorinated methylphenoxymethylphenols. The production of some of these compounds depends on the number of equivalents of chlorine per mol of compound and the reaction pH. These results show that treatment with chlorine of water contaminated with phenolic compounds leads to the production of chlorinated phenoxyphenols (predioxins), which are precursors of the highly toxic chlorinated dibenzo-p-dioxins. (See also W87-00794) (Author's abstract) W87-00793

CHEMICAL CHANGES OF ORGANIC COM-POUNDS IN CHLORINATED WATER: XI.
THIN-LAYER CHROMATOGRAPHIC FRAC TIONATION OF AMES MUTAGENIC COM-POUNDS IN CHLORINE-TREATED 4-METH-YLPHENOL SOLUTION,

Tokyo Univ. (Japan). Faculty of Pharmaceutical

S. Onodera, M. Yamashita, S. Ishikura, and S.

Journal of Chromatography JOCRAM, Vol. 360, No. 1, p 137-150, June 6, 1986. 8 fig, 3 tab, 36 ref.

Descriptors: *Organic compounds, *Path of pullutants, *Fate of pollutants, *Chlorination, *Gas chromatography, Mass spectrometry, Chlorinated hydrocarbons, Bioassay, Assay, Chemical analysis,

Effects Of Pollution—Group 5C

Water treatment, Toxicity, Chromatography,

The diethylphenol after treatment with hypochlorite was mutagenic to the Ames Salmonella test strain TA100 in the absence of liver homogenate. Cas chromatography-mass spectrometry (GC-MS) showed the occurrence of at least 20 compounds in the extract chloro-4-methylphenols, chlorohydroxy-4-methylquinones, and chlorinated 4-methylphenol dimers. The diethyl ether extract was separated into several fractions by silica gel and polyamide thin-layer chromatography (TLC). The fractionated components were then examined for mutagenicity by means of Ames assays, and were identified by GC-MS. TLC fractionation of the extract revealed that the major components present in the extract are not mutagenic, but minor components (Ees than 4% of the total extract) are mutagenic. GC-MS analysis indicated the presence of chlorinated 4-methylphenol dimers in the fraction which exhibited the highest mutagenicity. (See also W87-00793) (Author's abstract) W87-00794

WATER QUALITY INDEX: APPLICATION IN THE WARRI RIVER, NIGERIA, Benin Univ., Benin City (Nigeria). Dept. of Zoolo-

gy. For primary bibliographic entry see Field 5A. W87-00802

CONTRIBUTION OF THE POLYCHAETE, NEANTHES JAPONICA (IZUKA), TO THE OXYGEN UPTAKE AND CARBON DIOXIDE PRODUCTION OF AN INTERTIDAL MUDPLAT OF THE NANAKITA RIVER ESTUARY,

JAPAN, Tohoku Univ., Sendai (Japan). Biological Inst For primary bibliographic entry see Field 2L. W87-00805

INVESTIGATIONS ON THE PREVALENCE OF HETEROPHYES SPECIES IN TWELVE POPU-LATIONS OF THE FIRST INTERMEDIATE HOST IN EGYPT AND SUDAN. Bochum Univ. (Germany, F.R.). Abt. fuer Spezial Zoologie und Parasitologie.

For primary bibliographic entry see Field 5F. W87-0889

IDENTIFICATION OF POLLUTANT OR TRACER SOURCES USING DISPERSION THEORY, Institute of Hydrology, Wallingford (England)
For primary bibliographic entry see Field 5A.
W87-00814

MODELLING THE EFFECTS OF HYDROLO-GICAL CHANGES ON STREAM WATER ACID-ITY.

III., Institute of Hydrology, Wallingford (England).
P. G. Whitehead, C. Neal, and R. Neale.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4,
p 353-364, May 30, 1986. 9 fig, 4 tab, 23 ref.

Descriptors: "Acid streams, "Groundwater, "Acid rain, "Chemical reactions, "Streams, "Hydrologic models, "Soil water, "Mathematical models, Per-colation, Equations, Baseflow, Aluminum, Hydro-gen ion concentration, Chemical analysis, Catch-ment basins, Buffering capacity.

A mathematical model describing the hydrology and chemical reactions associated with soil and groundwater compartments in a catchment is used to assess the effects of hydrological changes on stream water acidity. By altering the percolation equation in the model the proportion of baseflow to soil flow is altered. This radically affects the stream chemistry and it is shown that increasing haseflow can improve stream quality significantly. sucant chemistry and it is shown that increasing baseflow can improve stream quality significantly, reducing acidity and lowering aluminum levels. It is proposed that catchment experiments be estab-lished to investigate methods of altering the hy-drology to take advantage of the buffering capac-ity of the baseflow waters. (Author's abstract)

5C. Effects Of Pollution

W87-00820

TROPICAL ORGANIC SOILS ECOSYSTEMS IN RELATION TO REGIONAL WATER RE-SOURCES IN SOUTHEAST ASIA, Butler Univ., Indianapolis, IN. Holcomb Research

For primary bibliographic entry see Field 2G. W87-00002

LEACHING OF LIGNITE ASH BY RAIN AND ACID RAIN, Texas Tech Univ., Lubbock. For primary bibliographic entry see Field 5A. W87-00003

BIOCHEMICAL CORRELATES OF STRUCTURE AND STABILITY IN DIVERGENT PLANKTON COMMUNITIES, Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5A.
W87-00011

REVIEW OF PRIMARY PRODUCTION AND DECOMPOSITION DYNAMICS OF THE BELOWGROUND MARSH COMPONENT, Rutgers - The State Univ., Camden, NJ. Dept. of Biology. For primary bibliographic entry see Field 2H. W87-00014

BACTERIA AND MICROBIAL DISTRIBUTION IN ESTUARINE SEDIMENTS, Whitman Coll., Walla Walla, WA. Dept. of Biol-For primary bibliographic entry see Field 2L. W87-00015

NITROGEN CYCLING AND ESTUARINE INTERFACES; SOME CURRENT CONCEPTS AND RESEARCH DIRECTIONS, Maryland Univ., Cambridge. Horn Point Environmental Labs. For primary bibliographic entry see Field 2L. W87-00016

STATUS OF ANADROMOUS FISHES IN SOUTHEASTERN U.S. ESTUARIES, Unity Coll., ME. Center of Environmental Str For primary bibliographic entry see Field 2L. W87-00022

ACID DEPOSITION IN TEXAS: TECHNICAL SUMMARY AND PERSPECTIVE, VOLUME II, Espey, Huston and Associates, Inc., Austin, TX. For primary bibliographic entry see Field 5B. W87-00042

COMPARISON OF EXPERIMENTAL DE-SIGNS TO DETERMINE EFFECTS OF ACIDIC PRECIPITATION ON FIELD-GROWN SOY-BEANS, Brookhaven National Lab., Upton, NY. Dept. of

Energy and Environment.

S. Evans, K. F. Lewin, M. J. Patti, and E. A.

Cunningham.

Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-003949, Price codes: AQ2 in paper copy, AO1 in microfiche, Report No. BNL-32176, (1982). 15 p, 2 fig. 6 tab, 31 ref. Grant No. IAG 81-D-X0533 and DOE Contract No. DE-AC02-76CH00016.

Descriptors: *Acid rain, *Experimental design, *Soybeans, Seed treatment, Plant water potential, Rainfall, Crop yield, Hydrogen ion concentration, Simulated rainfall, Statistical analysis, Mathemati-

Experiments were performed to determine changes in seed yields of soybeans grown under standard

agronomic practices exposed to simulated acidic rain during the summer of 1981. Two experiments were performed. In one experiment, plants were shielded from all ambient rainfalls and simulated rainfalls were applied in one experiment, plants were shielded from all ambient rainfalls and simulated rainfalls were applied in quantities equal to the average amount of rainfall that occurs at the site. Seed yields of soybeans exposed twice weekly to simulated rainfalls of pH 4.1, 3.3, and 2.7 were decreased 10.7, 16.8, and 22.9%, respectively, compared with plants exposed to simulated rainfalls of pH 5.6. A treatment-response function of seed yield versus rainfall pM was y = 7.40 + 1.023x and had a correlation coefficient of 0.997. In a second experiment, soybean plants were not shielded from ambient rainfalls (weighted mean hydrogen ion concentration equal to pH 4.04) and received only small volumes of simulated rainfalls three times weekly. Plants exposed to simulated rainfalls of 4.1, 3.3, and 2.7 exhibited yield reductions of 2.7, 7.0, and 7.6, respectively, below yields of plants exposed to simulated rainfalls of pH 5.6. By best fit analyses, the equation that fits this latter relationship is expressed by y = 9.68 + 0.138x where y is seed mass per plant and x is the pH of the simulated rain. The correlation coefficient for this latter relationship was 0.97. The decrease in seed yield observed in both experiments was due to a decrease in number of pods per plant. (Author's abstract) abstract) W87-00043

POPULATION-LEVEL EFFECTS OF MULTI-PLE STRESSES ON FISH AND SHELLFISH, Oak Ridge National Lab., TN. Environmental Sci-For primary bibliographic entry see Field 6G. W87-00045

OVERVIEW OF OIL FIELD BRINE PROB-LEMS IN THREE ILLINOIS COUNTIES. Greater Egypt Regional Planning and Development Commission, Carbondale, IL.
For primary bibliographic entry see Field 4C.
W87-00048

LONG-TERM HYDROLOGIC MONITORING PROGRAM: GNOME SITE, EDDY COUNTY, Department of Energy, Las Vegas, NV. Nevada Operations Office. NEW MEXICO. For primary bibliographic entry see Field 5B. W87-00066

RESEARCH NEEDS TO ASSESS POPULA-TION-LEVEL EFFECTS OF MULTIPLE STRESSES ON FISH AND SHELLFISH, Oak Ridge National Lab., TN. Environmental Sci-

ences DW.

D. S. Vaughan, P. Kanciruk, and J. E. Breck.

Available from the National Technical Information

Service, Springfield, VA. 22161, as DE83-003386,

Price codes: A02 in paper copy, A01 in microfiche.

Report ORNL/TM-8375, November 1982. 31 p. 1

fig. 1 tab, 80 ref. Contract No. W-7405-eng-26.

Descriptors: *Water pollution effects, *Stress, *Population exposure, *Fish, *Shellfish, Popula-tion dynamics, Ecological effects, Lethal limit, Median tolerance limit, Toxicity, Model studies,

Because the cumulative effects of many stresses may cause the collapse of a population even when the effects of each stress alone may appear insignificant, assessment and prioritization of research needs concerning the effects of multiple stresses on fish and shellfish populations are desirable. Research needs have been developed for laboratory and field experiments and for mathematical methods useful for describing the effects of stress at the individual and population levels. Needs for laboratory and field research are concerned with (1) correcting inadequacies prevalent in earlier studies, (2) emphasizing usage of multispecies and microcosm studies, and (3) taking advantage of 'de facto' field experiments undergoing known stresses. Further development of theory is needed to (1) incorporate the influence of physical-chemical and bio-

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logical factors on toxicity, (2) describe sublethal effects of stress on growth and reproduction, and (3) relate toxic effects (lethal and sublethal) to internal toxicant concentrations rather than to ambient toxicant concentrations. Simpler modeling approaches should also be considered for both screening and comparison purposes. As more data become available for fish populations considered to be at risk, more complex models can be phased in sequentially. A combined bioenergetics-Leslie matrix approach is emphasized for comparing population-level predictions under alternative stress hypotheses. (Author's abstract)

DOCUMENTATION OF SED-A SEDIMENT/ WATER COLUMN CONTAMINANT MODEL, National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.

Research Lab.

G. A. Lang, and S. C. Chapra.

Available from the National Technical Information
Service, Springfield, VA. 22161, as PB83-169946,
Price codes: A04 in paper copy, A01 in microfiche.

NOAA Technical Memorandum ERL GLERL41, August 1982. 49 p, 5 fig, 3 tab, 5 ref, 2 append.

Descriptors: *SED, *Model studies, *Sediments, *Water pollution, Plutonium, Water column, Simulation analysis, Organic compounds, Inorganic compounds, Dissolved solids, Lakes, Mathematical models, Lake Michigan.

Presented is documentation of a mathematical model developed to simulate the contaminant level in the sediments and overlying water column of a well-mixed lake. The contaminant is segmented into three fractions, organic, morganic, and dissolved, each with different physical and kinetic properties. The principal application of the model would be prediction of the year-to-year and steady-state response of the water column and sediments to changes in the loading rate of contaminant and/or particulate matter. A simulation of 239-Pu in Lake Michigan is presented as an example of the model's use. (Author's abstract) W87-00073

REGIONAL ASSESSMENT OF POTENTIAL SENSITIVITY OF SOILS IN THE EASTERN UNITED STATES TO ACID PRECIPITATION, Oak Ridge National Lab., TN. Environmental Science Control of the Control of the

Oak Ridge National Lab., TN. Environmental Sciences Div.
R. J. Olson, D. W. Johnson, and D. S. Shriner.
Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-005157,
Price codes: A02 in paper copy, A01 in microfiche.
Publication No. 1899, ORNL/TM-8374, December 1982. 46 p. 16 fig, 10 tab, 25 ref. Contract No.
W-7400-eng-26.

Descriptors: *Acid rain, *Soil chemistry, *Soil sensitivity, *Regional analysis, Soil environment, Geology, Hydrogen ion concentration, Environmental effects, Cation exchange capacity, Air pollution effects.

Areas in the eastern United States are evaluated for their sensitivity to acid deposition by combining county-level information on soil chemistry, bedrock geology, terrain characteristics, and land-use information. The report presents three sets of sensitivity maps that represent continuing refinements in the sensitivity criteria and available data bases. Criteria were developed in cooperation with the Canada-United States Transboundary Working Group to obtain comparable sensitivity maps for both countries. The final analysis covered the eastern 37 states and excluded the 1013 counties that are predominantly agricultural or urban. Soils are characterized for their potential to undergo acidification from acid deposition. The criteria are moderate pH and low cation exchange capacity. The one soil type meeting these criteria occurs extensively only in 16 counties in Nebraska. The soils characterization map also shows low pH soils (potential for aluminum leaching) and peat soils (potential for acidifying precipitation). Areas are also classified for their potential to reduce the acidity of acid deposition prior to the transfer of acid inputs to aquatic systems. Low soil pH, low soil sulfate

adsorption capacity, bedrock with no buffering capacity, and steep terrain are factors associated with low potential to reduce acidity. Elight percent of the 2660 counties in the East were found to have low potential to reduce acidity with an additional 20% having moderate potential. Areas occur in northern Minnesota, Wisconsin, and Michigan; The New England states, parts of New York and Pennsylvania; the Appalachian mountains; and Florida. (Author's abstract)

CHEMICAL CONTAMINANTS IN EDIBLE, NON-SALMONID FISH AND CRABS FROM COMMENCEMENT BAY, WASHINGTON, Environmental Protection Agency, Seattle, WA. Region X. For primary bibliographic entry see Field 5B. W87-00076

FISH IN LAKE MICHIGAN: DISTRIBUTION OF SELECTED SPECIES, Michigan State Univ., East Lansing. Dept. of Geography. For primary bibliographic entry see Field 2H. W87-00078

REVIEW AND ANALYSIS OF EXISTING MODELING APPROACHES FOR ASSESSING POPULATION-LEVEL EFFECTS OF MULTIPLE STRESSES ON FISH AND SHELLFISH, Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 6G. W87-00079

EFFECTS OF WASTE DISPOSAL ON GROUNDWATER AND SOURCE WATER. International Association of Hydrological Sciences

ences.

Available from the IAHS, 2000 Florida Ave.,
Washington, DC. 20009. IAHS Publication No.
139, 1982. Proceedings of a Symposium held
during the First Scientific General Assembly of the
IAHS at Exeter, England, July 19-30, 1982. Edited
by R. Perry. 278 p.

Descriptors: *Water pollution effects, *Water disposal, *Groundwater pollution, *Surface water, Surface-groundwater relations, Path of pollutants, Water pollution sources, Thermal pollution, Model studies, Landfills, England, China, West Germany, Symposium.

The theme of this symposium is the effects of waste disposal on water quality and the papers broadly divide into those concerned with surface water quality, those concerned with groundwater quality and those relating to the transport of pollutants to groundwater through the unsaturated zone. The authors primarily consider problems of chemical pollution, with the exception of one, which is concerned with thermal effects in surface water. The surface water contributions include a range of modelling approaches, both for generalized and for specific quality parameters. Three papers consider the problems of urban runoff as a pollutant source and nutrient aspects of non-point sources are considered by others. Problems of metal pollution of the Rhine are reported, river sediment quality is discussed, and a review of river quality in Great Britain is presented. Papers concerned with groundwater quality range from those which consider theoretical aspects of groundwater flow, to discussions of specific problems experienced in China and West Germany. The largest single group of papers is concerned with the problems of pollutant transport to groundwater including in particular leachate from landfill sites. The range of scope is considerable, from the theoretical discussions of numerical modelling of unsaturated solute transport, to the practical aspects of waste tip management. (See also W87-00128 thru W87-00151) (Lantz-PTT)

DETERMINATION OF THERMAL POLLU-TION OF THE RIVER MEUSE,

Utrecht Rijksuniversiteit (Netherlands). Dept. of Geography. For primary bibliographic entry see Field 5B. W87-00131

BOTTOM SEDIMENT CHEMISTRY AND WATER QUALITY NEAR MOUNT EMMONS, COLORADO, Woodward-Clyde Consultants, Denver, CO. For primary bibliographic entry see Field 5B. W87-00132

ENVIRONMENTAL EFFECTS OF APPLYING FEEDLOT RUNOFF TO GRASSLAND PLOTS, Baghdad Univ. (Iraq). Coll. of Engineering. For primary bibliographic entry see Field 3C. W87-00136

BEHAVIOUR OF CYANIDE IN A LANDFILL AND THE SOIL BENEATH IT, Rijksinstitut voor Drinkwatervoorziening, Leidschendam (Netherlands). For primary bibliographic entry see Field 5B. W87-00141

WASTE DISPOSAL IN SCOTLAND AND ITS EFFECTS ON GROUND AND SURFACE WATERS, Forth River Purification Board, Edinburgh (Scotland). For primary bibliographic entry see Field 5D. W87-00143

CASE STUDY ON NON-POINT SOURCE PLANT NUTRIENT LOAD CALCUATIONS, Vigazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 5B. W87-00145

HELP, HOLLAND IS PLATED BY THE RHINE (ENVIRONMENTAL PROBLEMS ASSOCIAT-ED WITH CONTAMINATED SEDIMENTS), Waterloopkundig Lab. te Delft (Netherlands). W. Salomons, W. van Driel, H. Kerdijk, and R.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 255-269, 9 fig, 3 tab, 15 ref.

Descriptors: *Rhine River, *Sediment load, *Environmental effects, Heavy metals, Meuse River, Netherlands, Dredging, Cadmium, Agricultural runoff, Landfills, Groundwater pollution.

Physical and chemical processes cause an accumulation of about 2/3 of the metal load of the rivers Rhine and Meuse in the Netherlands. Accumulation takes place in freshwater basins fed by rivers and by the disposal of dredged material on land. Agricultural use of the landfill areas is restricted due to cadmium accumulation by crops. The accumulation of heavy metals by cows on river flood plains is low compared with uncontaminated reference areas. The disposal of dredged material on land influences the composition of the groundwater, disposal of dredged material in the marine environment causes a mobilization of cadmium. (See also W87-00127) (Author's abstract) W87-00149

EFFECTS OF COAL MINE WASTES OF NORDRHINE-WESTPHALIA ON GROUND-WATER.

NORDRHAND WATER,
Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
G. Matthess, R. Oetting, M. Schultz, and H.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at

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Exeter, England, July 19-30, 1982. p 271-278, 2 fig, 3 tab, 7 ref.

Descriptors: *Groundwater pollution, *Mine wastes, *Nordrhine-Westphalia, *Waste recovery, Mine drainage, Coal mines, West Germany, Chlorine, Sodium, Potassium, Seepage, Path of pollutines, Seepage, Seepage, Path of Pollutines, Seepage, Seepage,

Coal mine tailings are used in Nordrhine-Westphalia, West Germany, as embankment material in road construction. To evaluate their effects on groundwater quality, field and laboratory studies were performed. The ions Cl(-), Na(+) and K(+) are washed out quickly causing a measurable design. grounowater quaitty, field and laboratory studies were performed. The ions Cl(-), Na(-+) and K(+) are washed out quickly causing a measurable deterioration of groundwater mainly by the Cl(-), which is limited to a short period of time (order of magnitude: 1-2 years). The predominant effect is the contamination of seepage and groundwater by SO4(2-) originating from oxidation of sulphide or organically bound sulfur. This process starts with a certain delay, but lasts for a longer time (order of magnitude: tens of years). In connection with this process an increase of hardness (Ca(2+), Mg(2+)) is observed in many cases. The movement of heavy metals (Fe, Mn, Cd, Cr, Cu, Co, Ni, Pb, Nz) is compensated by geochemically controlled immobilization processes (adsorption, precipitation and co-precipitation) so that no relevant changes can be observed with respect to heavy metal concentrations in groundwater. (See also W87-00127) (Author's abstract) thor's abstract) W87-00150

UNDERWATER LIGHT-FIELD OF LAKES WITH MARKED PHYSICOCHEMICAL AND BIOTIC DIVERSITY IN THE WATER COLUMN,

Univ., Hobart (Australia). Dept. of Botany. For primary bibliographic entry see Field 2H. W87-00164

EFFECTS OF TEMPERATURE, SALINITY, IR-RADIANCE AND DIURNAL PERIODICITY ON GROWTH AND PHOTOSYNTHESIS IN THE DIATOM NITZSCHIA AMERICANA: LIGHT-

DIATUM NITZSCHIA AMERICANA: LAGHI-LIMITED GROWTH, North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences. R. L. Miller, and D. L. Kamykowski. Journal of Plankton Research JPLRD9, Vol. 8, No. 1, p 215-228, January, 1986. 4 fig, 4 tab, 57 ref.

Descriptors: *Salinity, *Photosynthesis, *Diatoms, *Water temperature, *Diurnal distribution, Population dynamics, Photosynthesis, Estuaries, Phytoplankton.

The effects of variations in temperature (10, 15, 20, 25, 30 degrees) and salinity (8, 15, 20, 26, 32 parts per trillion) on cell size and rates of photosynthesis and population growth were evaluated in axenic, light-limited (20 microE/sq m/sec) cultures of an estuarine clone of the diatom Nitzachia americana. Experimental conditions were chosen to reflect the range of natural conditions which occur in the clone's native environment, the Cape Fear River Estuary, North Carolina. Rates of light-limited gross photosynthesis, or photosynthetic efficiency clone's native environment, the Cape Fear River Estuary, North Carolina. Rates of light-limited gross photosynthesis, or photosynthetic efficiency (PSE), were determined from short-term (1 hr) C14 incubations. Diurnal variation in PSE was analyzed using C14 samples taken during times of estimated maximum and minimum rates of diurnal photosynthesis. The salinity-dependent temperature response of PSE is characterized by a gradual increase in rates up to a temperature optimum at 25 degrees, beyond which rates rapidly decline to zero at an upper lethal limit (30-40 degrees). A similar pattern was observed in population growth rates as a function of salinity and temperature. Independent of temperature, optimum salinity for growth was 25 parts per trillion. A maximum growth rate of 2.4 divisions/day was measured at 25 degrees and 26 parts per trillion. The effect of non-optimum salinity is a reduction in growth rates relative to a predicted temperature-dependent maximum. Salinity-dependent patterns of variation in cell-volume, in general, mirrored the response of population growth such that cultures with relatively high growth rates were dominated by small

cells. Significant diurnal variation was observed in PSE; maximum diurnal rates were generally 1.5-3.5 times greater than minimum diurnal rates. (Author's abstract) W87-00165

ISOLATION OF INDIGENOUS WASTEWATER BACTERIAL STRAINS CAPABLE OF MOBILIZING PLASMID PBR325, Drexel Univ., Philadelphia, PA. Dept. of Bioscience and Biotechnology. For primary bibliographic entry see Field 5A. W87-00167.

MICROBIAL RESPONSE TO CRUDE OIL AND COREXIT 9527: SEAFLUXES ENCLOSURE

Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences. For primary bibliographic entry see Field 5B. W87-00178

ECOLOGICAL STUDIES ON CHIRONOMIDS IN TOKYO III, TOLERANCES OF TWO SPECIES OF CHIRONOMID LARVAE COLLECTED FROM THE ZEMPUKUJI RIVER TO OXYGEN DEFICIENCY, Tokyo Metropolitan Research Lab. of Public Health (Japan).

M. Ohno.

Japanese Journal of Ecology, Vol. 35, No. 1, p 103-111, march, 1985. 4 fig, 3 tab, 12 ref.

Descriptors: *Dissolved oxygen, *Midges, *Rivers, *Oxygen requirements, Oxygen uptake, Larvae, Oxygen deficit, Ecological effects, Zempukuji

Tolerance to low dissolved oxygen contents was examined in two species of chironomid larvae collected from different regions of the Zempukuji River. Chironomus yoshimatsui, which was dominant in the upper region (characterized by weak water flow and severe oxygen deficiency at night), was tolerant of low oxygen content. On the other hand, Cricotopus bicinctus, which was generally less dominant in the lower region (characterized by faster water flow and less severe oxygen deficiency), was sensitive to the low content of oxygen. Rarity of C. bicinctus in the upper region may be explained by its sensitivity to the low oxygen content. Oxygen consumption of the chironomic larvae was measured at various concentrations of dissolved oxygen in water. It seemed that onomic larvae was measured at various concentrations of dissolved oxygen in water. It seemed that
hyperbolic relations existed between the oxygen
consumption rates of the chironomids and the
oxygen concentrations reduction of oxygen consumption rates accompanied by lowering of
oxygen concentration was not significantly different between the two chironomids per individual
weight, but the more tolerant C. yoshimatsui
showed less reduction per unit body weight. (Author's abstract)
W87-00180 W87-00180

COMMUNITY RESPONSES TO ORGANIC LOADING IN A MICROCOSM,

Tohoku Univ., Sendai (Japan). Biological Inst. S. Shikano, and Y. Kurihara. Japanese Journal of Ecology, Vol. 35, No. 3, p 297-305, September, 1985. 6 fig. 1 tab, 29 ref.

Descriptors: *Organic loading, *Bacteria, *Cyano-phyta, *Chlorella, *Protozoa, *Rotifers, *Oligo-chaetes, Biomass, Aquatic populations, Ecosys-tems, Dissolved solids, Ammonia, Hydrogen ion concentration, Ecological effects, Water pollution effects, Invertebrates.

Experiments to see the relationship between the community responses to organic loading and successional age of the community were performed in aquatic microcosms consisting of bacteria, Bluegreen alga, ciliate protozoa, rotifer and aquatic oligochaete. Invertebrates in the microcosm delined to extinction when organic loading was added at a young stage, while invertebrates in the mature stage hardly became extinct after loading. Algae in the sediment, which increases as successions.

sion proceeded, contributed to the stabilization of invertebrate populations. Invertebrates in the microcosms loaded at a young stage were found to be extinct by temporary rise of the uniodized ammonia concentration, which was caused by the accumulation of total ammonia (due to the small amount of algae in the sediment) and by high pH. On the other hand, the mature microcosm showed high stability because a large amount of algae and low pH inhibited the increase of un-ionized ammonia subsequent of loading. (Author's abstract) W87-00181

SHORT-TERM PHOTOSYNTHETIC RE-SPONSES IN THE DIATOM NITZCHIA AMERICANA TO A SIMULATED SALINITY

North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences. For primary bibliographic entry see Field 2L. W87-00183

METEOROLOGICAL FACTORS AFFECTING
THE BLOOM OF ANABAENOPSIS RACIBORSKII WOLOSZ. (CYANOPHYTA: HORMOGONALES) IN THE SHALLOW LAKE BALATON, HUNGARY,
Balatoni Limnologiai Kutato Intezete, Tihany

Balatoni Limnoiogiai Autato intezere, rimany (Hungary). L. G. Toth, and J. Padisak. Journal of Plankton Research JPLRD9, Vol. 8, No. 2, p 353-363, March, 1986. 7 fig. 2 tab, 39 ref.

Descriptors: *Algal growth, *Eutrophication, *Cyanophyta, *Eutrophic lakes, Zooplankton, Lakes, Nutrients, Sediment transport, Rainfall, Wind velocity, Water temperature, Phytoplankton, Monitoring, Hungary, Lake Balaton.

From September to October, 1982, there was a heavy bloom of a nitrogen-fixing blue-green alga Anabaenopsis raciborskii Wolosz. in Lake Balaton. The dynamics of the phytoplankton and bacterio-plankton of the lake were studied by daily and weekly samplings of plankton biomass and composition. Meterological measurements of water temperature, sunshine duration, precipitation values and wind velocity were also taken. It was concluded that the causes of the bloom were accumulating nutrients that were enriched just before the bloom-period by sediments washed into the lake by heavy rains, followed by windless warm days with water temperatures in the range of 26 to 29 degrees. An expressed correlation between bacterioplankton and phytoplankton indicates their close trophic relationship. (Geiger-PTT)

NITRATE REDUCTASE: AN IMPROVED ASSAY METHOD FOR PHYTOPLANETON, Tel-Aviv Univ. (Israel). Dept. of Biochemistry. For primary bibliographic entry see Field 5A. W87-00186

GRAZING OF PLANKTONIC DIATOMS BY MICROFLAGELLATES,
British Columbia Univ., Vancouver. Dept. of

Botany. For primary bibliographic entry see Field 2H. W87-00187

CONSTRUCTION OF CAPE PERON OCEAN OUTLET PERTH, WESTERN AUSTRALIA, Metropolitan Water Authority, Perth (Australia). ctor of Engineering.

B. G. Cox, and K. J. Kelsall. Proceedings of the Institution of Civil Engineers, Part 1, Vol. 80, p 465-491, April 1986. 2 tab, 23 fig. 4 ref, 2 append.

Descriptors: *Eutrophication, *Wastewater treatment, *Ecosystems, Australia, Metropolitan Water Authority, Cockburn Sound, Cape Peron, Pipes.

Eutrophication of Cockburn Sound's 100 sq km of largely land-locked waters lying about 20 km south of Fremantle, Western Australia was well ad-

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vanced in 1979 when an environmental study confirmed that nutrients from a number of industries and from a major primary wastewater treatment plant operated by the Metropolitan Water Authority were causing extensive algal blooms. In June 1980, the Government initiated several measures to remedy this degradation of the sound's ecosystem. Oceanographic and ecological studies confirmed the environmental acceptability of primary treated wastewater dispersal into well-flushed ocean waters 4.2 km off Cape Peron. Design started in 1982. Land works began in January 1983 and included a 250 ML/day pumping station, 23 km of 1400 mm i.d. effluent pipeline and an oxygen injection station. Contract work for the ocean outlet and transition tower started at the same time. Perth's mediterranean-type climate at latitude 34 deg South creates conditions conducive to sulphide bacteria corrosion in cement mortar lined pipes. Special protective measures have been designed. Environmental impact constraints on land and marine operations set by the Environmental Protection Authority of Western Australia have been met. All land construction was complete by April 1984 and the project was commissioned for winter flow service in June 1984. (Alexander-PTT) W87-00194

COMPARATIVE EFFECTS OF PRECIPITA-TION ACIDITY ON THREE FOREST SOILS: CARBON CYCLING RESPONSES, Maine Univ. at Orono. Dept. of Chemical Engi-

Plant and Soil PLSOA2, Vol. 88, No. 1, p 101-112, 1985. 5 fig. 5 tab, 21 ref. EPA/NCSU Acid Precipitation Program, APP-0026M-1980, DOE

Descriptors: "Acid rain, "Water pollution effects, "Microbial degradation, "Respiration, "Organic carbon, Leaching, Forest soils, Soil bacteria, Hydrogen ion concentration, Acidity, Fulvic acids, Engineering of the Control of the C drogen ion concentration, Acidity, Fulvic acids, Environmental effects, Ecological effects, Organic

This comparative soil microcosm study examined the effects of precipitation acidity on decomposi-tion processes in three contrasting eastern North American forest soils: a Becket series Haplorthod, American forest soils: a Becket series Haplorthod, an Unadilla series Dystrochrept, and an Adams series Haplorthod. Results from all three soils showed that soil respiration is quantitatively unaffected by differences in precipitation acidity over the range of pH 5.7 to 3.5 (annual loading rates of 36 to 5,520 eq H(+)/ha). Soil respiration did vary as a function of edaphic differences between soils. Data from all three soils also indicated that precipitation acidity (at pH > or = 3.5 and lime potential Data from all three soils also indicated that precipitation acidity (at pH > or = 3.5 and lime potential > or = 1.11) had no consistent quantitative effect upon total dissolved organic carbon leaching. Again, differences in DOC flux were related to inter-soil edaphic variations. Carbon turnover budgets for the three soils indicated that 54-68% of the forest floor carbon loss occurred through respiration, while DOC leaching accounted for the remaining 32-46% of carbon loss. Finally, results from all three soils showed that increased inputs of strong acids to the forest floor caused distinct decreases in the hydrophobic acid (fulvic acid) content of leachate dissolved organic carbon. (Author's abstract) thor's abstract)

EFFECTS OF ALUMINUM AND LOW PH ON GROWTH AND DEVELOPMENT IN RANA TEMPORARIA TADPOLES,

Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.

Oecologia OECOBX, Vol. 69, No. 2, p 248-252, May 1986. 6 fig, 2 tab, 19 ref.

Descriptors: *Hydrogen ion concentration, *Acid rain, *Acidic waters, *Aluminum, *Growth rates, *Tadpoles, Reproduction, Metamorphosis, Scot-land, Acidification.

Rana temporaria tadpoles were raised to metamorphosis at aix levels of pH (pH 3.6-6.5) and two levels of AI (800 and 1,600 microgram/liter) at pH

4.4. Treatments involved both chronic and acute exposure to depressed pH. Decreasing pH reduced maximum body size and delayed metamorphosis. Growth was depressed and metamorphosis delayed by 800 microgramg/liter Al, and several tadpoles died at foreleg emergence. At 1,600 microgram/liter Al, small tadpoles suffered arrested growth and development and eventually died, whereas larger tadpoles metamorphosed without delay, though at a very small size. There was no mortality among controls. The levels of pH and inorganic monomeric Al measured in the experiments were similar to field levels at a site in Scotland, a it is concluded that individual tadpoles will, in certain types of water body, be adversely affected by acidity and Al. The ability of individual tadpoles to sarvive and metamorphose under a particular set of conditions should not be taken as proof population in the long term. (Alexander-PTT)

EFFECT OF NITRATE ON BIOGENIC SUL-

Pride Production,
Oklahoma Univ., Norman. Dept. of Botany and
Microbiology. an, M.J. McInerney, and R.M.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 6, p 1205-1211, June 1986. 3 fig. 1 tab, 42 ref. U.S. Department of Energy Contracts DE-AC19-80BC10300 and DE-AS05-

Descriptors: "Water pollution effects, "Nitrate, "Sulfide production, "Lake sediments, "Sludge, "Oil fields, "Brines, "Oxidation, Nitrite, Nitrous oxide, Reazurin, Bacterial physiology, Sulfate-reducing organisms, Glucose, Toxicity.

The addition of 59 mM nitrate inhibited biogenic sulfide production in dilute sewage sludge (10% (vol/vol)) amended with 20 mM sulfate and either acetate, glucose, or hydrogen as electron donors. Similar results were found when pond sediment or oil field brines served as the inocultum. Sulfide production was inhibited for periods of at least 6 mo and was accompanied by the oxidation of resazurin from colorless (reduced) to pink (oxidized). Lower amounts of nitrate (6 or 20 mM) and increased amounts of sewage sludge results in only transient inhibition of sulfide production. The addition of 156 mM sulfate to bottles with 59 mM nitrate and 10% (vol/vol) sewage sludge or pond sediment resulted in sulfide production. Nitrate, nitrite, and nitrous oxide were detected during periods where sulfide production was inhibited, whereas nitrate, nitrite, and nitrous oxide were The addition of 59 mM nitrate inhibited bioge periods where sulfide production was inhibited, whereas nitrate, nitrite, and nitrous oxide were below detectable levels at the time sulfide production began. The oxidation of resazurin was attributed to an increase in nitrous oxide which persisted in concentration of shout 1.0 mM for up 5 mo. The numbers of sulfate-reducing organisms decreased from 1,000,000 colony-forming units/ml sludge to less than detectable levels after prolonged incubation of oxidized bottles. The addition of 10 mM glucose to oxidized bottles after 14.5 wk of incubation resulted in reduction of the resazurin and subsequent sulfide production. The prolonged inhibition of sulfide production was attributed to an increase in oxidation-reduction potential due to biogenic production of nitrous oxide, which appeared to have a cytotoxic effect on sulfate-reducing populations. (Author's abstract)

IMPACT OF STORMS ON HETEROTROPHIC ACTIVITY OF EPILIMNETIC BACTERIA IN A SOUTHWESTERN RESERVOIR, Texas Univ. at Arlington. Dept. of Biology. For primary bibliographic entry see Field 2H. W87-00258

COINCIDENT PLASMIDS AND ANTIMICRO-BIAL RESISTANCE IN MARINE BACTERIA ISOLATED FROM POLLUTED AND UNPOL-LUTED ATLANTIC OCEAN SAMPLES, Maryland Univ., College Park. Dept. of Microbi-Ology. A.M. Baya, P.R. Brayton, V.L. Brown, D.J.

Applied and Environmental Microbiology AEMIDF, Vol 51, No. 6 p 1285-1292, June 1986. 4 fig. 3 tab, 42 ref. NOAA Grant NA 79AA-D-00062, NSF Grant BSR-94-01397.

Descriptors: "Water pollution effects, "Plasmids, "Marine bacteria, "Outfall sewers, "Puerto Rico, "Maryland, "Antibiotic resistance, "Toxic wastes, Nitrobenzene, Dibutyl phthalate, Meta-cresol, Ortho-cresol, Nitroaniline, Tributyltin oxide, Quinon, Penicillin, Erythromycin, Nalidixic acid, Ampicillin, Kanamycin, Chloramphenicol, Gentamycin, Tetracycline, Bacterial analysis, Ocean City, Baccelonets.

Sewage effluent and outfall confluence samples were collected at the Barceloneta Regional Treatment Plant in Barceloneta, Puerto Rico, and outfall samples were collected at Ocean City, Maryland. Bacteria from the samples were enriched in marine broth 2216 amended with 1 microgram/ml of one of the following chemicals: nitrobenzene, dibutyl phthalate, m-cresol, o-cresol, 4-nitroaniline, bis(tributylin)oxide, and quinone. MICs of the chemicals were determined individually for all isolates were evaluated for resistance to nine antibiotics and for the presence of plasmid DNA. Treated sewage contained large numbers of bacteria simultaneously possessing antibiotic resistance, chemical resistance, and multiple bands of plasmid DNA. Bacteria resistant to penicillin, erythromycin, nalidixic acid, ampicillin, bands of plasmid DNA. Bacteria resistant to peni-cillin, erythromycin, nalidixic acid, ampicillin, m-cresol, quinone, and bis(tributyltin) oxide were de-tected in nearly all samples, but only sewage out-fall confluence samples yielded bacterial isolates that were resistant to streptomycin. Bacteria resist-ant to a combination of antibiotics, including kana-mycin, chloramphenicol, gentamicin, and tetracy-cline, were isolated only from sewage effluent sam-ples. It is conclude that bacterial isolates derived from toxic chemical wastes more frequently con-tain plasmid DNA and demonstrate antimicrobial resistance than do bacterial isolates from domestic sewage-impacted waters or from uncontaminated sewage-impacted waters or from uncontaminated open ocean sites. (Author's abstract)

ELECTROSTATIC MECHANISM OF SURVIV-AL OF VIRULENT AEROMONAS SALMONI-CIDA STRAINS IN RIVER WATER, Hokkaido Fish Hatchery, Sapporo (Japan).

D.K. Sakai. Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 6, p 1343-1349, June 1986. 6 fig. 4 tab, 20 ref.

Descriptors: *Water pollution effects, *Bacterial survival, *River water, *Fish furunculosis, *Humic acid, *Tryptone, Sand, Electrophoresis, Ion ex-change columns, Amino acids, Bacterial physiolo-

Survival of Aeromonas salmonicida in river water was investigated by laboratory-based experiments with two virulent, autoagglutinating strains and two virulent, nonagglutinating strains. Cells of virulent, autoagglutinating strains. two virulent, nonaggiunnating strains. Cells of virulent strains were negative upon electrophoresis, whereas cells of avirulent strains were positive. Despite the loss of visible cells within a week in distilled water and physiological saline (0.85% NaCl), cells of the virulent strains survived for more than 15 wk in the presence of diluted humic more than 15 wk in the presence of diluted humic acid (10 microgram/ml), tryptone (10 microgram/ml) and cleaned river sand (100 g/100 ml of medium), but loss of viable cells occurred within 5 wk in the absence of sand. The cells of avirulent strains lost viability within 2 wk with no relation to the presence of sand. Using ion-exchange columns, humic acid and the amino acids of tryptone were shown to b anionic and cationic in water (pH 7.0), respectively. Sand particles had a high capacity to adsorb humic acid alone and amino acid-humic acid complexes. Sand particles accumulated 30-50 x the environmental concentration (10 microgram/ml) of amino acids on their surfaces, thereby permitting only bacterial cells carrying a net negative charge (virulent cells) to survive for long periods on the surface of the sand particles. (Rochester-PTT) W87-00261

Effects Of Pollution—Group 5C

EFFECTS OF AN ACID PRECIPITATION EVENT ON THE NEAR-SURFACE WATER CHEMISTRY OF AN OLIGOTROPHIC LAKE, Clemson Univ., SC. Dept. of Environmental Sys-tems Engineering

Clemson Univ., Sc. Dept. of Environmental Cystems Engineering.
R. W. Talbot, and A. W. Elzerman.
Water, Air, and Soil Pollution WAPLAC, Vol. 28,
No. 3/4, p 249-264, April 1986. 3 fig, 2 tab, 22 ref.
NSF Grant ISP-8011451.

Descriptors: *Precipitation, *Lakes, *Metals, *Acid rain, Rainfall, Oligotrophic lakes, Lake Keowee, South Carolina, Surface water, Hydrogen ion concentration, Zinc, Aluminum, Iron, Thermal specification.

Direct chemical interactions between acid precipitation and near-surface lake waters were examined. The dissolved phase chemical dynamics at several depths in the surface 0.5 m water column of an oligotrphic low-alkalinity lake are presented for a storm event which occurred on August 17, 1983. During precipitation periods pH decreases of up to 0.35 pH units were observed in surface waters. The good agreement between the time-depth profiles of temperature, excess H(+), and excess SO4(2-) strongly suggested that the major acidity component of the rain water (H2SO4) was primarily responsible for the decreased surface water pH. As a result of intrusion of cooler rain water into warmer surface waters, particulate matter apparently became trapped within layers of cooler water and was subsequently removed from near-surface waters by the sinking of these layers. Significant solubilization of Zn occured within these layers, presumably representing release from particulate solubilization of Za occured within these layers, presumably representing release from particulate matter subjected to lowered solution pH. In contrast to Zn, significant decreases occured in the concentrations of dissolved Al and Fe that may have resulted principally from formation of solid phases. (Author's abstract) W87-00330

ACUTE AND SUB-CHRONIC TOXICITY OF LEAD TO THE EARLY LIFE STAGES OF SMALLMOUTH BASS (MICROPTERUS DO-

LOMIEUI), Cornell Univ., Ithaca, NY. Dept. of Natural Re-

D. J. Coughlan, S. P. Gloss, and J. Kubota. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 265-275, April 1986. 2 fig, 2 tab, 33 ref.

Descriptors: *Toxicity, *Lead, *Fish, Bass, Bioassays, Water hardness.

Early life stages of smallmouth bass (Micropterus dolomieui) were exposed to Pb in acute (96 hour) and sub-chronic (90 day) bioassays (water hardness = 152 mg/L as CaCO3). After 96-hour static exposures at nominal Pb concentrations up to 15.9 mg/L, eggs and sac fry showed no increased mortality over that in controls. Swim-up fry (96-hr LC50 of 2.8 mg Pb/L) were more sensitive to Pb than were fingerling; 60 hr LC50 of 29.0 mg Pb/L) were more sensitive to Pb. LC50 of 2.8 mg Pb/L) were more sensitive to Pb than were fingerlings (96 hr LC50 of 29.0 mg Pb/L). The relation between dissolved Pb and mortality was non-significant for either swim-up fry or fingerlings. Fingerlings were exposed to Pb concentrations as high as 405 mg/L, for 90 day to evaluate effects on substrate selection, locomotor activity, weight and hemoglobin concentration in the blood were not significantly altered by any treatment. Hematocrit and leucocrit varied significantly but not in relation to Pb levels. Sub-chronic Pb exposure did not appear to represent a threat to Pb exposure did not appear to represent a threat to smallmouth bass in waters of medium hardness and above-neutral pH (7.1 to 7.9). (Author's abstract) W87-00331

BENTHIC FAUNA OF 41 ACID SENSITIVE HEADWATER LAKES IN NORTH CENTRAL

ONTARIO,
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
R. Dermott, J. R. M. Kelso, and A. Douglas.
Water, Air, and Soil Polluton WAPLAC, Vol. 28, No. 3/4, p 283-292, April 1986. 1 fig, 6 tab, 32 ref.

Descriptors: *Lakes, *Water pollution effects, *Benthic fauna, *Acid rain, *Acidity, Bottom sediments, Aquatic animals, Headwater lakes, Acid-

sensitive lakes, Softwater lakes, Ontario, Species diversity, Water depth.

the benthic fauna of 41 nonhumic, soft water lakes situated north of lakes Superior and Huron were sampled during 1980. The pH range of the lakes sampled was 4.6 to 7.7. The benthic infauna displayed regional differences in abundance and composition, with large variation within each district. Total abundance, blomass, and number of taxa were not correlated with lake pH or alkalinity. The Chironomidae abowed a slight change in percent composition of the major species (p<0.2) with lower pH. The Tanytarsini and Chironomius group increased in abundance in those lakes with lower pH. Other factors appear to control the distribution of the various invertebrate orders, with depth and sediment nature being important variables. (Author's abstract)

EFFECT OF THE QUANTITY AND DURA-TION OF APPLICATION OF SIMULATED ACID PRECIPITATION ON NITROGEN MIN-ERALIZATION AND NITRIFICATION IN A FOREST SOIL,

FOREST SOIL, Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy. T. M. Klein, and M. Alexander. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 309-318, April 1986. 5 fig, 1 tab, 12 ref.

Descriptors: *Forest soils, *Acid rain, *Nitrogen, Precipitation, Mineralization, Simulation, Rainfall, Nitrates, Hydrogen ion concentration.

The effect of the rate of application of simulated acid rain on N mineralization and nitrification in a forest soil was studied by applying different quantities of simulated rain for varying periods of time. The soil was exposed in the laboratory to simulated rain at pH 3.5, 4.1, or 5.6 at rates equivalent to 1.5, 2.3, 4.6, 7.1 or 15 times the average rate of precipitation in the field, and then mineralization of soil N or oxidation of added ammonium was determined. The rates of N mineralization were inhibited by precipitation at pH 3.5 or 4.1 when applied for 27 to 234 day at rates 1.5 times greater than that which occurs in nature. Nitrogen mineralization was not affected by simulated rain at pH 3.5 or 4.1 in soils exposed for 156 day at 2.3 times the natural rate of precipitation, for 27 or 81 day at 4.6 times the natural rate, or for 234 day at 1.3 times the natural rate, or for 234 day at 1.5 times the natural rate. Mineralization was fastest in soil exposed to pH 3.5 rain for 234 day at 4.6 times the natural rate of precipitation and for 81 day at 15 times the natural rate. Nitrate formation in soil amended with ammonium was inhibited by rain of pH 3.5 regardless of the intensity of rain or the duration of exposure. For a constant rate of rain application, the inhibition of nitrate formation in ammonium-amended soil generally increased with longer periods of exposure. The data show that the use of different rates of additions of artificial rain or different periods of exposure to the simulated precipitation will lead to different conclusions on the influence of acid rain on N mineralization in soil. (Author's abstract)

ACCLIMATION AND RESPONSE OF ALGAL COMMUNITIES FROM DIFFERENT COMMUNITIES FROM SOURCES TO ZINC TOXICITY. Illinois State Water Survey, Peoria. Water Quality

W. Wang. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 335-349, April 1986. 9 fig, 2 tab, 7 ref.

Descriptors: *Algae, *Water pollution effects, *Acclimatization, *Zinc, Algal growth, Toxicity, Ecosystems, Ecology, Illinois, Farmington, Peoria.

Algae from two different sources, Peoria and Farmington, Illinois, exibited distinctively different response patterns to Zn toxicity. This study was undertaken to find the cause of the variation in response. Further experiments proved that when the Peoria algae were acclimated to a low Zn

environment, they behaved like the Farmington algae. The Farmington algae behaved like the Peoria algae if they were allowed to acclimate in water samples containing higher Za concentrations. The results indicate that the toxic response of an algal community is greatly dependent upon specific environment and algal acclimation to it, regardless of the origin of algal sources. (Author's abstract) W87-00336

MUTAGENIC ACTIVITY OF SOILS AMEND-ED WITH TWO REFINERY WASTES, Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences. K. W. Brown, K. C. Donnelly, J. C. Thomas, P. Davol, and B. R. Scott. Water, Air, and Soil Pollution WAPLAC, Vol. 29, No. 1, p 1-13, May 1986. 4 fig, 4 tab, 16 ref.

Descriptors: *Soil amendments, *Mutagenicity, *Industrial wastes, Salmonella, Sludge, Biodegradation, Sludge digestion, Aspergillus, Storm runoff, Organic compounds.

runoff, Organic compounds.

The mutagenic potential of the acid, base, and neutral fractions of petroleum sludge amended soil was determined using the Salmonella/microsome assay and Aspergillus methionine assay. Organic compounds were extracted from two different soils amended with either storm-water runoff impoundment or combined API-separator/slop-oil emulsion solids waste. Application of either waste to soil reduced the mutagenic activity of organic compounds extracted from equal weights of soil. However, biodegradation increased both the total and the direct-scting mutagenicity of all fractions residual in the waste-amended soil. The maximum level of mutagenic activity per milligram residual C was detected in the sample collected 360 days after waste application for the acid and base fractions from the storm-water runoff impoundment amended soils and the acid, base, and neutral fractions from the storm-water runoff impoundment amended soils and the acid, base, and neutral fractions of the combined API separator/slop-oil emulsion waste amended soils. The mutagenic potential of both wastes was reduced by soil incorporation. The Salmonella assay indicated that while the bulk of the solvent extractable organics in both wastes was rendered non-mutagenic, the mutagenic potential of the organic compounds in the acid fraction from the storm-water runoff impoundment aludge amended soil was increased. The Aspergillus assay of both wastes indicated that the mutagenic potential of all three fractions was eventually reduced to a level that would be considered non-mutagenic. Thus, while degradation may have increased the mutagenic potential of specific organic compounds that were residual in the soil, the overall effect of degradation was to reduce the weighted activity of the waste amended soil. (Author's abstract) W87-00344

INFLUENCE OF MACROPHYTE DECOMPO-SITION ON GROWTH RATE AND COMMUNITY STRUCTURE OF OKEFENOKEE SWAMP

BATERIOPLANKTON, Georgia Univ., Athens. Inst. of Ecology. For primary bibliographic entry see Field 2H. W87-00357

ADAPTATION OF AQUATIC MICROBIAL COMMUNITIES TO QUATERNARY AMMONIUM COMPOUNDS, R. M. Ventullo, and R. J. Larson.
Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 356-361, February 1986. 2 fig, 3 tab, 42 ref.

Descriptors: *Biodegradation, *Microbial degrada-tion, *Ammonium compounds, *Bacteria, Hetero-trophic bacteria, Toxicity, Lakes.

The effects of long-chain (C12 to C18) quaternary ammonium compounds (QACa) on the density, heterotrophic activity, and biodegradation capabilities of heterotrophic bacteria were examined in situ in a lake ecosystem. Monoalkyl and dialkyl substituted QACs were tested over a range of concentrations (0.001 to 10 mg/liter) in both acute

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(3h) and chronic (21 day) exposures. In general, none of the QACs tested had significant adverse effects on bacterial densities in either acute or chronic studies. However, significant decreases in chronic studies. However, significant decreases in bacterial heterotrophic activity were noted in bacterial heterotrophic activity were noted in acute studies at QAC concentrations form 0.1 to 10 mg/liter. Chronic exposure of lake microbial communities to a specific monoalkyl QAC resulted in an adaptive response and recovery of heterotrophic activity. No-observable-effect level in the adapted populations was >10 mg/liter. Chronic exposure also resulted in significant increases in the number and activity of bacteria capable of biodegradation capability was observed at low (microgram per liter) concentrations which are approximately the same as realistic environmental levels. The studies indicated that exposure of lake microbial communities to QACs results in the development of adapted communities which are less sensitive to potential toxic effects and more active in the biodegradation of these materials. (Author's abstract) W87-00361

EFFECTS OF ORGANIC ENRICHMENT ON MEIOFAUNAL ABUNDANCE AND COMMUNITY STRUCTURE IN SUBLITTORIAL SOFT

SEDIMENTS,
Institute for Marine Environmental Research,
Plymouth (England).
J. M. Gee, R. M. Warwick, M. Schaanning, J. A.
Berge, and W. G. Ambrose, Jr.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 91, No. 3, p 247-262, September 26, 1985. 2 fig. 3 tab, 44 ref, append.

Descriptors: *Water pollution effects, *Sediments, *Enrichment, *Nematodes, Mesocosms, Meiofauna, Aquatic animals, Organic enrichment, Solbergstrand, Oslofjord, Norway, Community structure, Soft sediments, Special diversity.

ture, Soft sediments, Special diversity.

In experimental mesocosms established at Solbergstrand, Oalofjord, Norway, organic enrichment was effected by the addition of powdered Asch-phyllumnodosum (L.) Le Jol., in quantities equivalent to 50 g C/aq m and 200 g C/aq n, to boxes of sublittoral soft sediments. After 56 days, the structure of the melofaunal communities in these treatments was compared with that of the control boxes. The miofaunal communities at each level of organic enrichment were markedly different from each major components of the meiofauna. Although the abundance of nematodes was slightly reduced in the high dose treatment this was not accompanied by detectable changes in community structure. Harpacticoid copepod increased significantly in abundance in the treatment boxes and showed a general trend towards increased dominance and decreased diversity with increasing levels of organic enrichment; in the low dose treatment there was also an increase in the number of species present. The nematode/copepod ratio is unreliable as a biomonitoring tool and it is suggested that the differential responses in community structure between the nematode and copepod components of the meiofauna might be a better indicabion of stress at the community level. (Author's abstract) W87,00369

CARBOHYDRATE FLUCTUATIONS, GAS VA-CUOLATION, AND VERTICAL MIGRATION OF SCUM-FORMING CYANOBACTERIA IN FISHPONDS,

Hebrew Univ. of Jerusalem (Israel). Div. of Micro-bial and Molecular Ecology. For primary bibliographic entry see Field 2H. W87-00380

INFLUENCE OF EXTERNAL CATION CON-CENTRATION ON THE HATCHING OF AM-PHIBIAN EMBRYOS IN WATER OF LOW PH, Pennsylvania State Univ., University Park. Dept. of Biology.

of Biology.

J. Freda, and W. A. Dunson.

Canadian Journal of Zoology CJZOAG, Vol. 63,

No. 11, p 2649-2656, November 1985. 6 fig, 3 tab,

28 ref. USDI FWS Cooperative Agreement No. 1416000091548

Descriptors: "Hatching, "Amphibians, "Acidic water, "Embryonic growth stage, Hydrogen ion concentration, Water quality, Heavy metals, Magnesium, Calcium, Sodium, Lethal limit, Mortality.

Amphibian embryos exposed to water of low pH were killed by two distinct mechanisms. At very low pH levels, embryos stopped development soon after exposure to test solutions. At higher but still lethal pH levels, embryos became curled within a shrunken perivitelline space and failed to hatch (curling defect). The addition of Ca, Mg, and to a lesser extent Na (> 10 mg/L), prevented the early mortality of embryos in acidic water. However, increasing concentrations of these ions also caused the curling defect. Embryos of Ambystoma maculatum and Ambystoma jeffersonianum were generily able to hatch even though they became curled, but Rana sylvatica remained trapped and died. Consequently, as the concentration of Ca, Mg, or Na was increased at low pH, greater numbers of embryos of A. maculatum and A. jeffersonianum hatched, while survival of embryos of R. sylvatica was drastically reduced. (Author's abstract) W87-00394

UPTAKE OF PHOSPHORUS AND NITROGEN BY MYRIOPHYLLUM AQUATICUM (VEL-LOZA) VERD, GROWING IN A WASTEWATER

TREATMENT SYSTEM,
Dandenong Valley Authority (Australia).
For primary bibliographic entry see Field 5D.
W87-00396

DIATOM CHRONOLOGY FOR SEDIMENTS IN A HIGH ACCUMULATION RATE ENVI-RONMENT: RUPERT INLET, BRITISH CO-

LUMBIA, Memorial Univ. of Newfoundland, St. John's.

Memoriai Univ. of Novamber 1988.

A. E. Hay, and R. Waters.
Limnology and Oceanography LIOCAH, Vol. 30, No. 4, p 898-906, July 1985. 7 fig. 4 tab, 16 ref. NSERC Strategic Grant G0208.

Descriptors: *Sediments, *Diatoms, *Mine wastes, Accumulation rates, Seasonal variation, Rupert Inlet, British Columbia, Gravity Cores, Eutroph-ication, Phytoplankton, Chlorophyll a, Tidal ef-fects, Settling velocity.

Concentration profiles of large diatoms in gravity cores from the rapidly accumulating mine tailing deposit in Rupert Inlet exhibit variations with sediment depth which are ascribed to seasonal effects. Time-series of near-surface chlorophyll a measurements and phytoplankton cell counts, together with observations of an unusually massive bloom of Coscinodiscus gigas, are used to attribute peak concentrations of frustules of C. gigas, Coscinodiscus centralis, and C. Radiatus in the sediments to late spring-midsummer and early fall blooms of these species. Sediment accumulation rates estimated form the frustule concentration profiles range from 57 to 120 cm/yr and are similar to rates obtained from bathymetric and continuous seismic profiling surveys. From these rates it is inferred that very fine laminae (about 0.1 mm thick) may be tidally induced, and a rough estimate of 5 m/d is made for the in situ settling velocity of C. gigas. (Alexander-PTT) (Alexander-PTT) W87-00400

MODELING THE RESPONSE OF GREEN-HOUSE-GROWN RADISH PLANTS TO ACIDIC RAIN,

Argonne National Lab., IL. Environmental Research Div.

search DIV.
P. M. Irving.
Environmental and Experimental Botany
EEBODM, Vol. 25, No. 4, p 327-338, November
1985. p 327-338, 6 fig. 9 tab, 12 ref. EPA Agreement DW930126-01-0, Electric Power Research Inst. Contract RP 1908-1

Descriptors: *Acid rain, *Hydrogen ion concentra-tion, *Vegetation effects, *Plant growth, *Plant physiology, *Simulated rainfall, Photosynthesis, Crop yield, Plant tissues, Sulfates, Nitrates, Nitric acid, Sulfuric acid.

Three dose-response studies on radish plants exposed to simulated rain were performed in a greenhouse. Experiments showed negative effects on marketable yield from simulated rain having pH levels below 3.8 and 3.4. The threshold level may have depended on environmental condition with levels below 3.8 and 3.4. The threshold level may have depended on environmental conditions which affected overall growth rates. In modeling experimental results, high levels of acidity had an overwhelming influence on the dose-response function used to describe the results. Plants treated with highest acidity levels had reduced leaf area resulting in lower photosynthesis per plant which may have resulted in reduced yields. The sulfate to nitrate ratio in simulated rain also influenced radish response. Nitric acid appeared to have a greater effect than sulfuric acid in reducing yield at pH 3.0. (Michael-PTT) W87-00409

RESPONSES OF THREE WHEAT CULTIVARS TO SIMULATED ACID RAIN,
Oak Ridge National Lab., TN. Environmental Sci-

ences Div.

J. W. Johnston, and D. S. Shriner.
Environmental and Experimental Botany
EEBODM, Vol. 25, No. 4, p 348-353, November
1985. 2 fig. 3 tab, 15 ref. Interagency Agreement
DOE 40-740-78, EPA 79-X0533, DOE Contract
DE-AC05-840R21400.

Descriptors: *Acid rain, *Vegetation effects, *Hydrogen ion concentration, *Plant growth, *Plant physiology, *Simulated rainfall, Crop growth, Wheat, Plant tissues, Sulfuric acid, Nitric acid.

Seedlings of three wheat cultivars were exposed to simulated acid rain to determine their responses to a broad range of acidity levels. Parameters measured included foliage weight, tiller number and the number of leaves with more than 10% necrosis per pot. Results showed that acid rain at average ambient levels caused reduced growth of two cultivars and had no effect on the third. At higher acidity levels than normally encountered in rain, all three cultivars showed enhanced growth. Tillering increased with rain acidity for one cultivar, but was constant for the other two. The number of leaves with more than 10% tip necrosis increased with rain acidity for each cultivar. Results demonstrate that differences in cultivar sensitivity should be considered when assessing the impact of acid rain on crop productivity. (Michael-PTT)

REGULATORY DEVELOPMENT OF THE INTERIM AND REVISED REGULATIONS FOR RADIOACTIVITY IN DRINKING WATER PAST AND PRESENT ISSUES AND PROB-

Environmental Protection Agency, Washington, DC. Office of Drinking Water. For primary bibliographic entry see Field 5B. W87-00411

FIELD STUDY OF RA ACCUMULATION IN TROUT WITH ASSESSMENT OF RADIATION DOSE TO MAN, Colorado State Univ., Fort Collins. Dept. of Radi-ology and Radiation Biology. For primary bibliographic entry see Field 5B. W87-00414

HEAVY METAL CONCENTRATIONS IN THE OYSTERS SACCOSTREA CUCCULLATA AND SACCOSTREA SP. FROM THE DAMPIER ARCHIPELAGO, WESTERN AUSTRALIA, Western Australia Dept. of Conservation and En-

vironment, Perth.

Australian Journal of Marine and Freshwater Research AJMFA4, Vol. 36, No. 2, p 169-175, March/April 1985. 2 fig, 5 tab, 9 ref.

Descriptors: *Path of pollutants, *Heavy metals, Metals, *Oysters, Mollusks, Dampier Archipelago, Australia, Silver, Cobalt, Chromium, Manganese, Nickel, Lead, Pollution, Cadmium, Copper, Zinc,

WATER QUALITY MANAGEMENT AND PROTECTION-Field 5

Effects Of Pollution-Group 5C

Ranges of concentrations (mg/kg wet wt) of Ag (0-0.4), Cd (0-0.8), Co (not detected), Cr (0-0.8), Mn (0.4-3.2), Ni (0.2-1.7) and Pb (0-1.7) were determined in S. cuccullata and Saccostres sp. (probably S. commercials) from several locations in the Dampier Archipelago and nearby Cape Lambert. Concentrations of Cu and Zn in individual specimens of these oysters ranged from 1.4 to 555 and from 55 to 1800 mg/kg wet weight, respectively, reached their maximum values at localized areas adjacent to the Dampier township and iron-ore exporting terminals at Dampier and Cape Lambert, and correlated significantly with lengt and wet weight. Fe concentrations in individual oysters throughout the Archipelago, which is the center of an iron-ore exporting industry, ranged from 4.2 to 1629 mg/kg wet weight and did not correlate significantly with oyster length or wet weight. (Author's abstract)

COUPLED TRANSFORMATION OF INOR-GANIC STABLE CARBON-13 AND NITRO-GEN-15 ISOTOPES INTO HIGHER TROPHIC LEVELS IN A EUTROPHIC SHALLOW LAKE National Inst. for Environmental Studies, Yatab (Japan). For primar W87-00477

nary bibliographic entry see Field 2H.

MASS MORTALITY OF FISH AND INVERTE-BRATES ASSOCIATED WITH A BLOOM OF HEMIDISCUS HARDMANNIANUS (BACIL-LARIOPHYCEAE) IN PARANGIPETTAI (SOUTHERN INDIA), Annamalia Ulviv, Annamalainagas (India), Centre Annamalia Ulviv, Annamalainagas (India), Centre

(SOUTHERN INDIA), Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Biology. A. Subramanian, and A. Purushothaman. Limnology and Oceanography LIOCAH, Vol. 30, No. 4, p 910-911, July 1985. 1 tab, 4 ref.

Descriptors: *Mortality, *Fish, *Eutrophication, *Invertebrates, Clams, Oysters, India, Parangipet-

A bloom of Hemidiscus hardmannianus (Bacillario-phyceae) in the estuarine and neritic waters of Parangipettai (southern India) lasted for 3 days beginning on 17 August 1982. The bloom was associated with heavy mortality of fishes and invertebrates. Plankton samples were collected and the cells counted. The largest component was found to be H. hardmannianus. All other species contributed to only 2% of the plankton population. (Jessick-PTT) W87-00480

METABOLISM AND DISPOSITION OF 2,3,7,8,-TETRACHLORODIBENZO-P-DIOXIN IN RAINBOW TROUT, Wisconsin Univ.-Madison. Environmental Toxicol-

ogy Center. J. M. Kleeman, J. R. Olson, S. M. Chen, and R. E.

Peterson.
Toxicology and Applied Pharmacology, Vol. 83, No. 3, p 391-401, May 1986. 6 fig, 2 tab, 33 ref.

Descriptors: "Path of pollutants, "Organic compounds, "Trout, "Tissue analysis, "Fate of pollutants, Pollutants, TcDD, Dioxin, Toxicity, Fish physiology, Lethal limit, Metabolism, Liquid chromatography, Tetrabrodibenzo-p-dioxin, Tritium, Chemical analysis.

Accumulation, tissue distribution, and depuration of 2,3,7,8,-tetrachlorodibenzo-p-dioxin (TCDD)-derived 3-H were studied in fingerling rainbow trout fed a diet containing 494 ppt (3H)TCDD for 13 weeks followed by the same diet without TCDD for 13 weeks. This exposure did not cause fin rot, cutaneous hemorrage, reduced growth rate, or an increase in relative lethality in TCDD-exposed fish. Visceral fat, carcass, skin, and pyloric caeca and all fatty tissues, accounted for greater than 90% of the TCCD-derived 3-H in the fish after the 13-week exposure period. The remaining TCDD-derived radioactivity was distributed to skeletal muscle, gill, gastrointestinal tract, liver, kidney, heart, and spleen. High-pressure liquid chromatographic analysis of 3-H in skeletal

muscle, liver, kidney, carcass, and visceral fat showed that it was primarily due to TCDD (> or = 98%) and not metabolites (< or = 2%). The 1/2 for whole-body depuration of TCDD-derived 3H was 15 weeks, and individual organ t1/2 values ranged from 8 to 19 weeks. To determine if rainbow trout metabolize TCDD, adult fish were injected with (14C)TCDD(60 microgram/kg ip), and gallbladder bile, liver, salectal muscle, and kidney were analyzed 1 week later. While only the compound was found in the tissues, bile contained at least three TCDD metabolites and the parent compound. Beta-Glucurondaise treatment of the bile suggested that at least one TCDD metabolite was a glucuronide conjugate. (Author's abstract)

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN METABOLISM AND DISPOSITION IN YELLOW PERCH, Wisconsin Univ.-Madison. Environmental Toxicol-ogy Center. J. R. Olson, S. M. Chen, and R. E. J. M. Kleeman, J. R. Olson, S. M. Chen, and R. E.

Toxicology and Applied Pharmacology, Vol. 83, No. 3, p 402-411, May 1986. 5 fig, 1 tab, 27 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Organic compounds, *Perch, Fish, Pollutants, *Water pollution effects, *Tissue analysis, Tetrachlorodibenzo-p-dioxin, TCDD, Dioxin, Yellow Perch, Metabolites, Toxicity, Metabolism, Fate of pollutants, Tritium, Liquid chromatography, Chemical analysis.

rate of poliutanis, Iritum, Liquid chromatography, Chemical analysis.

Accumulation, tissue distribution, and depuration of 2,3.7,8-tetrachlorodibenzo-p-dioxin (TCDD) derived 3-H were examined in fingerling yellow perch fed a diet containing 494 ppt of (3H)TCDD for 13 weeks followed by the same diet without TCDD for 13 weeks. None of the TCDD-exposed perch showed any signs of overt toxicity such as reduced growth rate, fin necrosis, cutaneous hemorrhage, or lethality. At the end of the 13-week exposure period, 78% of the total body burden of TCDD-derived 3-H was contained in the carcass and visceral fat while the remaining 22% was spread out among the liver (9%), gill (5%), skin (3%), skeletal muscle (2%), gastrointestinal tract (1%), plyonic cacca (1%), kidney (<1%), spleen (<1%), and heart (<1%). High-performance liquid chromatographic analysis of organic extracts of visceral fat, carcass, liver, skeletal muscle, and skin showed that 96-99% of the tritium extracted from these tissues was due to the parent compound. The estimated t1/2 for whole-body depuration of TCDD-derived 3-H was 18 weeks, and individual organ t1/2 values ranged from 6 to 19 weeks for the gastrointestinal tract, pyloric caeca, liver, gill and carcass, and from 24 to 49 weeks for the visceral fat, kidney, skin, skeletal muscle, and spleen. To determine if yellow perch metabolize TCDD, a single dose of (14C)TCDD was administered to adult yellow perch (60 microgram/kg, jp and, 1 week later, gallbladder bile, liver, skeletal muscle, and kidney where the parent compound accounted for 96-99% of the extractable 14-C, the gallbladder bile contained almost entirely TCDD retabolites. At least pny. In contrast to the liver, muscle, and kidney where the parent compound accounted for 96-99% of the extractable 14-C, the gallbladder bile contained almost entirely TCDD metabolites. At least four TCDD metabolites were detected in yellow perch bile and beta-glucuronidase treatment of the bile suggested that at least one was a glucuronide conjugate. (Author's abstract) W87-00482

CADMIUM IN TISSUES OF JAPANESE QUAIL FED OAT GRAIN GROWN ON MUNICIPAL SLUDGE-AMENDED SOIL, New York State Coll. of Agriculture and Life Sciences, Ithaca. Toxic Chemicals Lab. For primary bibliographic entry see Field 5B. W87-00495

SALMONELLA CARRIAGE BY HERRING GULLS IN THE CLYDE AREA OF SCOTLAND IN RELATION TO THEIR FEEDING ECOLO-Glasgow Univ. (Scotland). Dept. of Zoology.

For primary bibliographic entry see Field 5B. W87-00502

GASTROENTERITIS: CASE STUDY OF A COL-ORADO OUTBREAK.

Ohio Univ., Athens. Coll. of Health and Human R. S. Hopkins, R. J. Karlin, G. B. Gaspard, and R.

American Water Works Association Journal JAWWA5, Vol. 77, No. 1, p 40-44, January 1986. 1 fig, 3 tab, 10 ref. EPA Contract 68-03-2927, EPA Agreement CR-80880101.

Descriptors: *Public health, *Water pollution effects, *Drinking water, *Water treatment, Human diseases, Water treatment facilities, Cost analysis, Filters, Chlorination, Epidemiology.

A waterborne nonbacterial gastroenteritis outbreak occurred in March 1981 in the Colorado communities served by the Eagle-Vail Water District. The outbreak was linked to a chlorinator failure as well as a long-standing filter deficiency and malfunction of an upstream sewage treatment plant. Illness was statistically associated with water consumption. The direct cost for medical care, time lost from work, purchase of bottled water, and emergency repairs to the water treatment system were estimated to have been \$258, 231 or \$73 per resident. Costs to rectify the problems discovered in the water treatment plant, including long-term improvements, were almost \$1.2 million. (Author's abstract) bstract) W87-00509

POTENTIAL HEALTH EFFECTS OF MERCU-RY IN WATER SUPPLY WELLS.

als Management Technology, Inc., Madison, WI.

T. R. Stolzenburg, R. R. Stanforth, and D. G. Nichols.

American Water Works Association Journal JAWWA5, Vol. 78, No. 1, p 45-48, January 1986. 2 fig, 2 tab, 15 ref.

Descriptors: *Wells, *Mercury, *Water pollution effects, *Public health, *Bioaccumulation, Fish, Shellfish, Heavy metals, Methylmercury, Biological magnification.

The cycling of mercury in the environment and in well water was studied to determine the seriousness of the threat to human health of the elemental mercury sometimes contained in water well equipment. Methylmercury in water becomes concentrated in fish and shellfish, and human poisoning appears to result from eating the contaminated god rather than through direct intake of contaminated water. Modeling of mercury cycling indicated that, because of unfavorable conditions, mercury in well water is highly unlikely to be methylated to the toxic methylmercury form. In addition, aquatic organisms, such as fish and shellfish, that can concentrate methylmercury and could be consumed by humans are not present in well water. sumed by humans are not present in well water. (Geiger-PTT) W87-00510

DISSOLVED OXYGEN MODEL FOR A DY-NAMIC RESERVOIR,

Youngstown State Univ., OH. Dept. of Civil Engi-

neering.
S. C. Martin, S. W. Effler, J. V. DePinto, F. B.
Trama, and P. W. Rodgers.
Journal of Environmental Engineering (ASCE)
JOEEDU, Vol. 111, No. 5, p 647-664, October
1985. 7 fig, 3 tab, 26 ref, 2 append.

Descriptors: *Dissolved oxygen, *Mathematical models, *Reservoirs, *Model studies, Simulation analysis, Oxygen depletion, Sensitivity analysis, Hypolimnion, Oxygen deficit, Reservoir operation, Lake sediments, Water pollution effects, Nutrients, New Jersey.

A time-variable one-dimensional mathematical model has been applied to Round Valley Reser-voir, New Jersey, to test its credibility for simulat-

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ing oxygen resources in the hypolimnia of dynamic reservoirs. In particular, the model was used to simulate the documented accelerated depletion of hypolimnetic dissolved oxygen (DO) that accompanied the use of the reservoir to augment flow in a nearby river. The model successfully simulated the reduction in hypolimnetic dissolved oxygen that occurred, and displayed potential as a valuable research and management tool for the reservoir. For example, the model results suggested that the observed acceleration in the DO depletion was mostly due to a decrease in the volume of the hypolimnion. Both a sensitivity analysis and a comparison of individual sources and sinks conducted with the model indicated that sediment oxygen demand (calibration value = 0.43 g/sq m/day) was the most important component of the oxygen budget in the hypolimnion of the reservoir. (Author's abstract) thor's abstract) W87-00518

IMPACT OF LAKE ACIDIFICATION ON

IMPACT OF LAKE ACIDIFICATION ON STRATIFICATION, Upstate Freshwater Inst., Inc., Syracuse, NY. S. W. Effler, and E. M. Owens. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 6, p 822-832, December 1985. 2 fig, 1 tab, 26 ref.

Descriptors: *Acid rain, *Water pollution effects, *Stratification, *Model studies, *Lakes, Transparency, Thermal stratification, Models, Mathematical models, Mathematical studies, Fisheries, Acidity, Acidic water, Ecological effects.

The effects of documented acidification-based in-creases in transparency or decreases in diffuse light attenuation, k sub d/m, on the occurrence and character of thermal stratification in lakes was character of thermal stratification in lakes was studied with a mathematical mixed layer (integral energy) stratification model. Predicted changes in the character of stratification in deep lakes includ-ed deeper epilimnia, reduced density gradients in metalimnia, increased hypolimnetic heating, and reduced stability. These changes, brought about as a result of a reduction in k sub d from 0.75-0.15/m, a result of a reduction in k sub d from 0.75-0.15/m, were generally as great as or greater than those associated with extremes in meteorological conditions in a north temperate climate. These changes in stratification may have important effects on the vertical cycling of dissolved constituents and the oxygen resources of hypoliminia. The model predicted that lakes of maximum depth of <25 m located in the Adirondack Region of New York State may change in character from exhibiting State may change in character from exhibiting strong summer stratification to stratifying only weakly or not at all as a result of similar decreases in the k sub d. In addition, shallower lakes are more susceptible to less extreme reductions in the k sub d. As a result of this effect, a number of lakes in the Adirondack Region have probably been eliminated as cold-water fisheries. (Geiger-PTT) W87.00525

PLASMA IONIC COMPOSITION OF THE AT-LANTIC SALMON (SALMO SALAR), WHITE SUCKER (CATOSTOMUS COMMERSOND, AND ALEWIFE (ALOSA PSEUDOHABENGUS) IN SOME ACIDIC RIVERS OF NOVA SCOTIA, Department of Fisheries and Oceans, St. Andrews (New Brunswick). G. L. Lacroix.

Canadian Journal of Zoology CJZOAG, Vol. 63, No. 10, p 2254-2261, October 1985. 3 fig. 5 tab, 37

Descriptors: "Acidic water, "Salmon, "Alewife, "Acid rain, "Sucker, "Water pollution effects, Rivers, Blood, Hydrogen ion concentration, Ecological effects, Fish, Fish physiology.

Atlantic salmon smolts migrating from two acidic rivers (pH 4.9 and 5.2) had higher hematocrit levels (> 50%) and low plasma. The hematocrit level was 10% higher and plasma Na(+) was 17% level was 10% inginet and passma Nat. | Was 17% of the more acidic of the two rivers. Salmon parr in rivers of mean pH 5.0, 5.4, and 6.0 over a 7 month period had high hematoric levels and low plasma. Plasma Na(+) and Cl(-) were both slightly less and plasma K(+) was higher in parr from the river of pH 5.0 than in

those from the other two rivers. Atlantic salmon smolts were more sensitive to low pH than parr, and parr of the 0+ age-class were more sensitive than 1+ parr. Prespawning white suckers and alewives migrating in a river at pH 4.9 had high hematocrit levels and low plasma Cl(-), and alewives were more severely affected than suckers (hematocrit, 4.2%; plasma Cl(-), 91 milliequivalents/liter). Plasma Ca(2+) in females of both species was not greatiy elevated relative to males suggesting a possible impairment of calcium metabolism associated with ovarian development. The physiological effects observed in fish inhabitating soft waters at pH levels of about 5.0 generally correlated well with the laboratory 'models' of acid exposure in soft water. (Geiger-PTT)

EFFECTS OF SIMULATED ACID RAIN AND (+ OR -)-2-(2,4-DICHLOROPHENOXY) PROPANOIC ACID ON SELECTED CROPS, Technical Univ. of Demmark, Lyngby. Lab. of Environmental Science and Ecology.

B. R. Larsen.

Ecotoxicology and Environmental Safety EESADV, Vol. 10, No. 2, p 228-238, October 1985. 2 fig, 5 tab, 43 ref.

Descriptors: *Crop production, *Herbicides, *Ecological effects, *Acid rain, *Water pollution effects, Pesticides, Environmental effects, Hydrogen ion concentration, Acidic water, Barley, Carrots,

The effect of foliar-applicated (+ or -)-2-(2,4-dichlorophenoxy) propanoic acid (2,4-DP) under simultaneous influence of simulated acid rain at pH intropientoxy propanoic acid (24-DP) under simultaneous influence of simulated acid rain at pH levels of 3.3, 4.3, and 5.6 was examined for young plants of white mustard, rape, cress, lettuce, radish, carrot, oat, and barley grown in climate chambers. After 1-2 weeks with daily showers plants received a single foliar application of 2,4-DP in aqueous solution (500 microliters; 0.25-50.0 milligrams/liter). After a post-treatment period of 2-3 weeks with daily showers the plants were sampled. 2,4-DP at 5 milligrams/liter or higher concentrations caused various symptoms for the dicotyledons. Monocotyledons and carrot remained unaffected morphological changes, increased the symptoms from 2,4-DP, and reduced the dry weight and the leaf to stem ratio. Cress exposed only to acid rain showed necrotic spots and chlorosis at pH 3.3. Broduced worphological changes, increased the symptoms from 2,4-DP, and reduced the dry weight and the leaf to stem ratio. Cress exposed only to acid rain showed necrotic spots and chlorosis at pH 3.3. Broducer observed. The combined effect of acid rain and 2,4-DP was additive rather than synergistic. (Author's abstract) (Author's abstract) W87-00548

STEREOLOGICAL ANALYSES OF HEPATO-CYTE CHANGES PARALLEL ARSENIC ACCU-MULATION IN THE LIVERS OF GREEN SUN-FISH

FISH,
Texas Univ. at Austin. Dept. of Pharmacology.
E. M. B. Sorenson, R. Ramirez-Mitchell, A.
Pradzynski, T. L. Bayer, and L. L. Wenz.
Journal of Environmental Pathology, Toxicology,
and Oncology, Vol. 6, No. 2, p 195-210, November-December 1985. 2 fig. 2 tab, 32 ref.

Descriptors: *Water pollution effects, *Sunfish, *Liver, *Arsenic, Fish toxins, Fish physiology, Ecological effects, Bioaccumulation, Environmen-

Cellular changes in hepatocytes of green sunfish (Lepomis cyanellus) exposed to arsenic-contami-nated or control lake water were compared with the level of arsenic in the liver. Standard stereological procedures involved conversion of two-di-mensional data (i.e. fractional measurements of morphological changes) to three-dimensional data for interpretation. Both the volume and numbers of for interpretation. Both the volume and numbers of nuclei increased slightly with increasing concentrations of arsenic in the liver. Significant increases ($\rho < 0.01$) were observed in the volumes occupied by necrotic and fibrous bodies, respectively, when volume changes were considered on a unit body weight basis. The volume occupied by necrotic areas, abnormal lysosomes, and autophagic vacuoles increased arsenic concentration. The surface

density of rough endoplasmic reticulum increased with increasing arsenic concentration; linear regression resulted in a correlation coefficient of 0.8367 when data were based on unit body weight. (Author's abstract)
W87-00549

PHYTOPLANKTON CONTROL BY GRAZING ZOOPLANKTON: A STUDY ON THE SPRING CLEAR-WATER PHASE, Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.). Dept. of Ecophysiology. For primary bibliographic entry see Field 2H. W87-00560

ALGAL GROWTH RESPONSE TO PARTICLE-BOUND ORTHOPHOSPHATE AND ZINC, Geological Survey, Menlo Park, CA. Water Resources Div.

J. S. Kuwabara, J. A. Davis, and C. C. Y. Chang. Limnology and Oceanography LIOCAH, Vol. 31, No. 3, p 503-511, May 1986. 5 fig, 3 tab, 33 ref.

Descriptors: "Plant growth, "Zinc, "Orthophosphates, "Toxicity, "Titanium dioxide, "Nutrient availability, Plant growth, Plant physiology, Dissolved substances, Particle matter, Cultures, Primary productivity, Phosphorus, Ions, Buffering.

mary productivity, Phosphorus, Ions, Buffering. Effects of Zn (0-1 micromole total Zn(II)) and orthophosphate (8-12 micromole total P) additions on growth indices of Selenastrum capricornutum Printz were examined in a synthetic growth medium containing 50 mg/l colloidal titania. Over the Zn(II) concentration range used, effects detrimental to growth and yield were observed. Addition of P to a synthetic growth medium (S-3) increased stationary phase cell density, but had minimal effect on growth rate and duration of lag phase. TiO2 particles in culture media significantly reduced Zn and P dissolved fractions. Although adsorbed Zn and P were less available to Selenastrum, desorption of both solutes increased their availability. Rapid desorption of Zn(II) from TiO2 particles served in effect to buffer Zn(2+)-free ion concentration, until Zn became partitioned primarily with the algal fraction as cell concentration approached stationary phase density. Although phosphate desorption from TiO2 in nonbiological systems was negligible, Selenastrum was able to scavenge some P initially adsorbed on TiO2. Accurate primary productivity predictions in nature may require an understanding of equilibrium and scavenge some P initially adsorbed on TiO2. Accurate primary productivity predictions in nature may require an understanding of equilibrium and reaction rates involved in the partitioning of nutrients and toxic substances between dissolved and particulate phases. (Author's abstract) W87-00561

DILUTION OF 210PB BY ORGANIC SEDI-MENTATION IN LAKES OF DIFFERENT TROPHIC STATES, AND APPLICATION TO STUDIES OF SEDIMENT-WATER INTERAC-

Florida State Museum, Gainesville. For primary bibliographic entry see Field 2H. W87-00563

PRODUCTION OF PLANKTONIC BACTERIA

IN LAKE MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental
Research Lab.

For primary bibliographic entry see Field 2H. W87-00565

IMPORTANCE OF CONTAMINATED FOOD FOR THE UPTAKE OF HEAVY METALS BY RAINBOW TROUT (SALMO GAIRDNERI): A

RAINBOW TROUT (SALMO GAIRDNERI): A FIELD STUDY, Innsbruck Univ. (Austria). Inst. fuer Zoologie. R. Dallinger, and H. Kautzky. Oecologia OECOBX, Vol. 67, No. 1, p 82-89, August 1985. 5 fig, 8 tab, 36 ref.

Descriptors: *Water pollution effects, *Heavy metals, *Rainbow trout, *Sediments, *Moss, *Isopods, *Snails, *Predation, Food chain, Detritus,

Effects Of Pollution—Group 5C

Zinc, Copper, Cadmium, Lead, Chromium, Gills, Fish diets, Fish physiology, Nickel, Manganese,

Concentrations of Zn, Cu, Cd, Pb, Cr, Ni, and Mn were measured in water, sediments, and organisms from Augraben and Leiferer Graben, two contaminated rivers situated in an industrial area and near a motorway on the southern city boundary of Bolzano, Italy. Low metal contents of water contasted with elevated concentrations in sediments, indicative behavior exther them souther terminations. zano, Italy. Low metal contents of water contasted with elevated concentrations in sediments, indicating a chronic rather than acute contamination of the rivers. The metal concentrations in the dominant moss Fontinalis antipyretrica were higher than those of sediments, and the lower branches of the plant had higher concentrations than the upper parts. The isopod Asellus aquaticus and the snail Lymnaea truncatula were the dominant inverterates; both fed on contaminated moss or detritus and accumulated heavy metals to an even greater extent than the water plants. The dominant predator, rainbow trout, fed mainly on metal-enriched isopods and snails. There was an absorption of heavy metals from the lumen of fish into the gut tissue and a flux to other organs such as liver, kidney, and muscle. Since the metal concentration of water are low it is suggested that absorption through the gills of fish may be of secondary importance compared with the excessive supply through the food. (Author's abstract) W87-00571

WATER QUALITY EFFECTS OF EXCAVA-TION AND DIVERSION, Army Engineer Waterways Experiment Station, Vicksburg, MS. Water Resources Engineering

Group.
F. D. Shields, and T. G. Sanders.
Journal of Environmental Engineering (ASCE)
JOEEDU, Vol. 112, No. 2, p 211-228, April 1986.
6 fig, 7 tab, 23 ref.

Descriptors: *Water quality, *Construction, *Sediments, Yellow Creek, Mississippi, Tennessee-Tombigbee Waterway, Channelization, Specific conductance, Turbidity, Color, Chemical oxygen demand, Alkalinity, Hardness, Ammonia, Phosphorus, Sulfates, Iron, Lead, Manganese, Tempera-

Water quality data collected from Yellow Creek in northeast Mississippi before and during construc-tion of the Divide Cut of the Tennessee Tombig-bee Waterway provide information regarding water quality effects of stream channelization and large-scale construction projects. Observed water quality changes were due to increased inputs of sediment and reduced shade. Statistically signifi-cant changes in variance and means were observed sediment and reduced shade. Statistically signifi-cant changes in variance and means were observed for most grab-sample variables. Mean values of specific conductance, turbidity, color, COD, and total alkalinity, hardness, ammonia, phosphorus, sulfate, iron, lead, and manganese were 50 to 100 per cent greater during construction than before construction. Estimated average daily loadings of total metals, nutrients, and dissolved solids were greater during construction. Average daily sus-pended sediment load was slightly less during con-struction. Average daily maximum stream temperpended sediment load was signtly less during con-struction. Average daily maximum stream temper-ature was 4 C greater, and coliform densities and phenol concentrations decreased. Total organic ni-trogen, phosphorus, iron, manganese, and zinc were significantly correlated with turbidity during construction, but only total phosphorus was conconstruction, but only total phosphorus was correlated with turbidity before construction. (Peters PTT W87-00590

DISTRIBUTION OF COPPER IN A RIVER SEDIMENT AND ITS BIOLOGICAL AVAILABILITY (KUPFERVERTEILUNG IN EINEM FLUSSSEDIMENT UND SEINE GISCHE VERFUGBARKEIT).

G. Gellert, and R. Wittassek.
Fresenius' Zeitschrift für Analytische Chemie
ZACFAU, Vol. 322, No. 7, p 700-703, December
1985. 4 tab, 32 ref.

Descriptors: *Copper, *Sediments, *Industrial wastes, Rivers, River Sieg, Benthos, Atomic absorption spectrometry, Metals.

Sediment and macrozoobenthos were tested for their copper content in a region of the river Sieg below a cable metal work. Copper could be analyzed directly from the dry weight with Zeeman AAS. Gradients in sediments and organisms ahowed copper enrichment originated from the cable metal work. Ephemerella ignita, Asellus aquaticus and Hydropsyche sp. accumulated copper. Easetis sp. seemed to regulate the copper uptake and Stictotarsus 12-pustulatus had a restrictive copper concentration. Differences in the copper uptake may relate to feeding type, sediment association, age, and size of organism. (Author's abstract)

ACUTE TOXICITY OF BRASS PARTICLES TO DAPHNIA MAGNA, Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD. D. W. Johnson, M. V. Haley, G. S. Hart, W. T. Muse, and W. C. Landis. Journal of Applied Toxicology JJATDK, Vol. 6, No. 3, p 225-228, June 1986. 1 fig, 3 tab, 16 ref.

Descriptors: *Toxicity, *Aquatic animals, *Daphnia, *Brass, Particulate matter, Ecosystems, Aquatic insects, Copper, Zinc, Fate of pollutants, Hydro-

genion concentration.

The aquatic toxicity of brass particles was examined in acute, 48 hour bioassays using the water flea, Daphina magna. Tests were conducted with uniform suspensions of uncoated brass particles, brass particles coated with Teflon solution, silica particles, and titanium dioxide particles. The Teflon coating solution and the supernatant of the brass suspension (after settling of the brass) also were tested. All tests were conducted according to guidelines set forth by the US Environmental Protection Agency and the Organization for Economic Cooperation and Development. Mean EC50 determinations of 20.0 microgram/L and 23.6 microgram/L were calculated for uncoated and coated brass particles, respectively. The silica, titanium dioxide, and Teflon each has an EC50 > 1 g/L. Chemical fate studies demonstrated that the brass dissocated to its ionic components of copper and zinc quickly at pH 2.0. At pH 5.0 and 6.5, the dissociation occurred too slowly to account for the observed toxicity. The data suggest that the toxicity is due to filtration by the daphnids and ingestion. EC50 determinations for the brass particles are nearly identical with published EC50 values for copper salts. (Author's abstract)

MUNICIPAL SEWAGE SLUDGE APPLICA-TION ON OHIO FARMS: HEALTH EFFECTS, Ohio State Univ., Columbus. Dept. of Veterinary Preventive Medicine.

For primary bibliographic entry see Field 5E. W87-00649

MUNICIPAL SEWAGE SLUDGE APPLICA-TION ON OHIO FARMS: TISSUE METAL RESIDUES AND INFECTIONS, Ohio State Univ., Columbus. Dept. of Veterinary Preventions hibitographic automore Field SE

For primary bibliographic entry see Field 5E. W87-00650

MUNICIPAL SEWAGE SLUDGE APPLICA-TION ON OHIO FARMS: ESTIMATION OF CADMIUM INTAKE, Ohio State Univ., Columbus. Dept. of Veterinary Preventive Medicine.

For primary bibliographic entry see Field 5E. W87-00651

ECOLOGY OF PLUMATELLA EMARGINATA (ECTOPROCTA:PHYLACTOLAEMATA) IN THE SURFACE WATERS OF MADHYA PRADESH WITH A NOTE ON ITS OCCURRENCE IN THE PROTECTED WATERWORKS OF BHOPAL (INDIA), Bhopal Univ. (India). Dept. of Limnology. For primary bibliographic entry see Field 5F.

W87-00655

CRUSTACEA (PROCAMBARUS CLARKII) RE-SPONSE TO AN ORGANOPHOSPHATE DIET. Louisiana State Univ., Baton Rouge. Center for Wetland Resources.

Environmental Pollution (Series A) EPEBD7, Vol. 39, No. 2, p 131-140, October 1985. 2 fig. 1 tab, 23 ref. EPA Grant R804976.

Descriptors: *Insecticides, *Water pollution effects, *Crustaceans, *Organophosphorous pesticides, *Crayfish, *Agricultural runoff, *Louisians, Diet, Procambarus, Wetlands, Public health, Toxicity, Contamination.

icity, Contamination.

Large quantities of the organophosphate Guthion, used to control insect infestation on large Louisiana plantations, can potentially enter nearby wetland habitats and commercially important crayfish populations. The absorption of Guthion to plant oils and organic sediments means that its impact on crayfish will include, and possibly be dominated by, its oral rather than dermal toxicity, Guthion was tested for acute and chronic oral toxicity with the red swamp crayfish Procambarus clarkii. The 48 hr LD50 of Guthion for adult crayfish was 1.9 mg/kg crayfish and was substantially higher than published dermal toxicity values. Chronic effects, tested at 25 microgram/kg of crayfish food for 8 months, had no effects on growth rates. However, the rate of senescence incessed for those crayfish began to die 2-3 months before their control counterparts. This was a life-span reduction of 15-20% for the males and 7-10% for the females. It is recommended that the establishment of runoff standards for organophosphates be based on the response of ecologically significant aquatic invertebrates to chronic contamination, both in the water and on food substances. (Author's abstract) W87-00636

EFFECTS OF AERIAL SPRAYING OF CHLOR-PHOXIM ON THE BRAIN ACETYLCHOLIN-ESTERASE ACTIVITY OF FISH FROM THREE RIVERS IN THE IVORY COAST, WEST

Institute of Aquatic Biology, Achimota (Ghana). L. A. K. Antwi.

Environmental Pollution (Series A) EPEBD7, Vol. 39, No. 2, p 151-159, October 1985. 1 fig. 2

Descriptors: "Water pollution effects, "Pesticieds, *Fish, "Africa, "Drganophosphorus pesticides, "Chlorphoxim, Pollutants, Acetylcholinesterase activity, Brain activity, Rivers, Ivory Coast, Tila-pia, Alestes, Ecosystems, Larvicides.

pia, Alestes, Ecosystems, Larvicides.

The effect of aerial treatment of rivers with chlorphoxim, in connection with the ongoing Onchocerciasis Control Program (OCP) in the Volta River Basin, on the brain acetylcholinesterase (AChE) activity of three fish species Tilapia galilaea, Tilapia zilli and Alestes nurse has been studied in the lovory Coast. A cage experiment with Tilapia zilli, placed just below the breeding site of Simulium damnosum s.l. in the river Marahoue and aerially treated with chlorphoxim at a concentration of 0.05 mg/liter per 10 min of river discharge, showed a 16% reduction in the brain acetylcholinesterase activity of the caged Tilapia zilli after 2 hr and about 20% after 5 hr of the river treatment. However, there was no reduction in the brian AChE activity of some Tilapia galilaea, Tilapia zilli and Alestes nurse randomly taken with a cast net from the rivers Bandama and N'zi, which had been similarly treated with chlophoxim for about 10 months. During river treatment the fish avoid the impact of the larvicide by swimming downstream. (Author's abstract) stream. (Author's abstract) W87-00657

SUBMERGED MACROPHYTIC VEGETATION IN RELATION TO EUTROPHICATION LEVEL IN KUMAUN HIMALAYA, Kumaun Univ., Naini Tal (India). Dept. of Botany.

Group 5C-Effects Of Pollution

R. Purohit, and S. P. Singh. Environmental Pollution (Series A) EPEBD7, Vol. 39, No. 2, p 161-173, October 1985. 1 fig. 4

Descriptors: "Water pollution effects, "Macrophytes, "Lakes, "Eutrophication, "Kumaun Himalaya, "India, Naukuchiya Tal, Bhim Tal, Naini Tal, Ecosystems, Biomass, Aquatic plants, Pollution.

Ecosystems, Biomass, Aquatic plants, Pollution. Three major lakes, Naukuchiya Tal, Bhim Tal and Naini Tal, of the Kumaun Himalayan region were studied to reveal any relationship between productivity of submerged macrophytes and lake eutrophication. These lakes were more or less similar in size but varied in regard to size of human population in the catchment. The level of eutrophication increased with the increasing catchment population size. The maximum depth to which macrophytes could colonize was directly related to the transparancy of the water. The productivity per unit area of the submerged community in these lakes increased as eutrophication increased. Among the dominant macrophytes, Ceratophyllum demersum and Myriophyllum spicatum attained their peak importance value (in terms of biomass and net productivity) at the lowest level of eutrophication, and Potamogeton pectinatus at the highest level of eutrophication. Hydrilla verticilata was recorded in each lake, and its importance value tended to increase with increasing eutrophication (Author's abstract). value tended to increase with increasing eutrophication. (Author's abstract)
W87-00658

EFFECT OF MERCURY ON SOME AQUATIC PLANTS, Institute of Science, Bombay (India). Dept. of

Botany.

G. N. Mhatre, and S. B. Chaphekar.

Environmental Pollution (Series A) EPEBD7,

Vol. 39, No. 3, p 207-216, November 1985. 1 fig. 3

Descriptors: *Water pollution effects, *Mercury, *Aquatic plants, *Bioindicators, Pollutants, *Aquatic plants, Aquatic life, Chlorophyll, Phytomass, Metals, Toxicity.

Three aquatic plants, Hydrilla verticillata Presl Pistia stratiotes L. and Salvinia molesta D. S. Mitchell, were treated with different concentrations of mercury ranging from 1 to 1000 micro-gram/liter at three different exposure durations, 1, 3 and 5h. They were all exceeds of the control of the co gram/liter at three different exposure durations, 3 and 5h. They were all severely affected by mercury. Foliar injury, chlorophyll content and phytomass showed preceptible effects with increasing exposure to the metal. In the case of floating plants a positive relationship was obtained between Leaf Injury Index (LII) and doses of the metal. The possible use of aquatic plants in general and floating plants. Lear Injury Index (LII) and doses of the metal. The possible use of aquatic plants in general, and floating plants in particular, as simple bioassay material in biomonitoring and toxicity studies is discussed with special reference to LII as a simple biomonitoring parameter. (Author's abstract)

EFFECT OF ACCLIMATISATION ON THE TOXICITY OF CHEMICALS TO ACTIVATED SLUDGE MICROORGANISMS,

Water Research Centre, Stevenage (England). For primary bibliographic entry see Field 5D. W87-00661

MIXED CULTURE BIOLOGICAL ACTIVITY IN WATER CONTAINING LOW CONCENTRA-TIONS OF CYANIDE, PHENOL AND BOD, Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-00663

SUBACUTE PHYSIOLOGICAL EFFECTS OF BLEACHED KRAFT MILL EFFLUENT (BKME) ON THE LIVER OF TROUT, SALMO GAIRD-

NERI,
Helainki Univ. (Finland). Dept. of Zoology.
A. O. J. Oikari, and J. Niittyla.
Ecotoxicology and Environmental Safety
EESADV, Vol. 10, No. 2,p 159-172, October 1985.

5 fig. 8 tab, 33 ref.

Descriptors: *Water pollution effects, *Physiological ecology, *Rainbow trout, *Fish, *Pulp wastes, *Bleaching wastes, Aquatic animals, Trout, Effuents, Toxicity, Pulp and paper industry, Phenols, Wastewater, Glycogen, Chlorinated hydrocar-

Rainbow trout (Salmo gairdneri) were exposed for 10 and 30 days to microbiologically treated effluent of a bleached kraft pulp and paper mill (BKME). Throughout the experiments, the quality of dilution water, taken from an upstream location close to the mill, was allowed to vary both diurnally and seasonally (September-October) in a natural manner. The test concentrations averaged 0 (control), 0.6, 1.2, 2.0, and 5.1% (v/v) of BKME. Conjugates of all major resin acids and chlorinated phenolics of BKME, except chlorocatechols, were detected in trout bile. They comprised 93.1-99.9% of the total amounts in the bile. The level of conjugated resin acids increased linearly with the content of BKME in test water. On the other hand, no increase in concentration of conjugated phenono increase in concentration of conjugated phenolics was seen above 2% BKME. In the blood lics was seen above 2% BKME. In the blood plasma no conjugates were analyzable. Concentrations of free resin acids in the blood plasma, but not in the bile, increased at high test concentrations of BKME. No active excretion of free resin acids from plasma to bile can be inferred, but some of the phenolics-particularly 3, 4, 5, 6, -tetrachloroguaiscol- seem to be concentrated in the bile as a free compound. Changes in several biochemical parameters did not display any simple relationship with the external concentrations of BKME. In intermediate exposure concentrations. with the external concentrations of DAME. In intermediate exposure concentrations, however, liver RNA and protein concentrations were de-creased after 10 days but concentrations of liver glycogen and water were unresponsive to BKME at the dilutions investigated. (Author's abstract)

INFLUENCE OF BENZENE ON THE PHYTO-PLANKTON AND ON DAPHNIA PULEX IN COMPARTMENTS OF AN EXPERIMENTAL

Gesellschaft fuer Strahlen- und Umweltforschung mb.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Oekologische Chemie. J. P. Lay, W. Schauerte, L. Peichl, W. Klein, and

Ecotoxicology and Environmental Safety EESADV, Vol. 10, No. 2, p 218-227, October 1985. 6 fig, 2 tab, 8 ref. Commission of the Europenunities Contract 187-77-IENVD.

Descriptors: *Water pollution effects, *Benzene, *Phytoplankton, *Daphnia, Plankton, Aquatic plants, Experimental ponds, Ponds, Toxicity.

Benzene, with initial concentrations of 100 and 50 Benzene, with initial concentrations of 100 and 50 mg per liter, was dosed in duplicates into four compartments of a small pond. The decrease of concentration in the water was exponential with a mean half-life of 4.7+ or - 0.9 days. Following benzene application, the phytoplankton density and diversity slightly increased relative to the controls. Both concentrations were lethal for the daphnids present. During 24-hr in vitro tests with Daphnia pulex (initial benzene concentrations < 50 mg ner liter), a direct correlation between mo-50 mg per liter), a direct correlation between mobility and decreasing chemical concentration was observed. (Author's abstract)

EFFECT OF DECAYING LEAVES ON THE PH AND BUFFER CAPACITY OF WATERS, Louisiana State Univ., Baton Rouge. Dept. of nistry.

P. M. Deano, and J. W. Robinson.

Journal of Enviormental Science and Health (A)

JESEDU, Vol. 20, No. 8, p 903-911, 1985. 3 fig, 10

Descriptors: *Buffer capacity, *Decaying leaves, *Leaves, *Acid rain, Vegetation, Hydrogen ion concentration, Water chemistry.

Acid rain has become a significant environmental problem in the United States. The survival of

aquatic life depends on the ability of the aquatic system to withstand acidic rainwater, which in turn is very dependant on the buffer capacity of the system. Thus the effect of decaying vegetation (leaves) from oak, pine and cypress trees on the buffer capacity of water was studied, because they are common in Louisiana and are a primary source of leaf litter in local lakes and streams. Results have shown that when the leaves decompose the pH was initially less, but over a period of time the pH and the buffer capacity increases. The increase in pH and buffer capacity depending on the species of leaves studied indicates that some leaves may be beneficial, and may help combat the effects of acid rain. But others, perhaps pine, aggrevates acidity problems. (Khumbatta-PTT)

SEWAGE EFFLUENT BIOMONITORING: L. SURVIVAL GROWTH AND HISTOPATHOLO-Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife. For primary bibliographic entry see Field 5A. W87-00681

SEWAGE EFFLUENT BIOMONITORING: IL BIOCHEMICAL INDICATORS OF AMMONIA EXPOSURE IN CHANNEL CATFISH, Michigan State Univ., East Lansi eries and Wildlife. ing. Dept. of Fish-For primary bibliographic entry see Field 5A. W87-00682

SEPTIC TANK DENSITY AND GROUND-WATER CONTAMINATION, Robert S. Kerr Environmental Research Lab. For primary bibliographic entry see Field 5B. W87-00684

PARTITIONING LIGHT ATTENUATION IN AN ACIDIC LAKE,
Upstate Freshwater Inst., Inc., Syracuse, NY.
S. W. Effler, G. C. Schafran, and C. T. Driscoll.
Canadian Journal of Fisheries and Aquatic Science
CJFSBX, Vol 42, No. 11, p 1707-1711, November
1985. 5 fig, 25 ref.

Descriptors: *Acidic water, *Lakes, *Acidic lakes, *Acid rain, *Light penetration, Opacity, Carbon, Dissolved organic carbon, New York, Aluminum, Dart's Lake, Thermal stability.

Although a number of researchers have reported that acidification of lakes is accompanied by an increase in transparency, there has been no systematic evaluation of the processes responsible for this transformation. The attenuation of light was partitioned in acidic Dar't's Lake, located in the Adirondack region of New York from May to September 1982. Changes in light attenuation K sub d and light absorption (a) were regulated largely by 'gelbstoff'. Substantial decreases in K sub d and (a) occurred through the study period and were corre-'gelbstoff'. Substantial decreases in K sub d and (o occurred through the study period and were correlated with a depletion in the concentration of dissolved organic carbon (DOC). In-lake concentrations of DOC were controlled by terrigeneous loading and in-lake processes. The decreases in DOC and the attendant decreases in (a) and K sub d were coupled to a loss of Al from the water column of the lake. Coagulation/absorption of DOC by Al may have helped in increasing lake clarity and decreasing the thermal stability of lakes. (Author's abstract)

STABLE CARBON AND NITROGEN ISOTOPE TRACERS OF TROPHIC DYNAMICS IN NAT-URAL POPULATIONS AND FISHERIES OF THE LAHONTAN LAKE SYSTEM, NEVADA, Carnegie Institution of Washington, DC. Geo-physical Lab.

M. L. F. Estep, and S. Vigg.
Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 42, No. 11, p 1712-1719, November 1985. 2 fig, 7 tab, 31 ref.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Effects Of Pollution—Group 5C

Descriptors: *Isotopic tracers, *Food chains, *Cyanophyta, *Trophic level, *Nevada, Isotope studies, Tracers, Carbon, Nitrogen, Fisheries, Lakes, Lahontan lake system, Inorganic compounds, Algae, Trout, Salmon, Diets.

pounds, Algae, Trout, Salmon, Diets.

The influence of combined inorganic N on the growth of N sub 2 fixing blue-green algae (Aphanizomenon flos-aquae) in Lahontan Reservoir was detected with N isotopic compositions that were enriched in 15-N. In Pyramid Lake, however, the delta 15-N of the entire food web was influenced by a contribution of isotopically light N released from N sub 2 fixing blue-green algae (Nodularia spumigena). Carbon isotope ratios delta 13-C of these unpalatable, blue-green algae from both lakes were different enough from the zooplankton and higher animals to preclude a direct trophic link. An enrichment in 13-C with tropic level in the food chain was measured in both lakes. Carbon isotopes ratio measurements clearly illustrated the isotopic similarity between hatchery-raised Lahontan cutthroat trout (Salmo clarki henshawi) and cui-ui (Chasmistes cujus) and the artificial diet, but differed from the delta 13-C of their wild counterparts consuming natural foods. There is a consistent isotope fractionation between the delta 13-C of scales and the delta 13-C of muche from fish that is species specific. These results demonstrate that fish scales, as well as muscle, can be used to determine diet. (Author's abstract) W87-00692

ALUMINUM BIOACCUMULATION AND TOXICITY TO DAPHNIA MAGNA IN SOFT WATER AT LOW PH,

Toronto Univ. (Ontario). Inst. for Environmental

M. Havas.

Canadian Journal of Fisheries and Aquatic Science CJFSBX, Vol. 42, No. 11, p 1741-1748, November 1985. 6 fig, 2 tab, 31 ref.

Descriptors: *Aluminum, *Acid rain, *Acidic lakes, *Toxicity, *Daphnia, *Hydrogen ion concentration, *Bioaccumulation, Soft water, Mortality, Fish, Aquatic animals, Calcium.

ty, Fish, Aquatic animals, Calcium.

Aluminum may be either harmful or beneficial to Daphnia magna (Straus) depending on pH and on the Al concentration in the water. Results are based on laboratory experiments conducted at various concentrations of total Al (0.02-1.02 mg/L) in soft water (2.5 and 12.5 mg Ca/L) adjusted from pH 6.5 to 4.5. Maximum Al toxicity and maximum Al bioaccumulation were observed at pH 6.5 (at and above 0.32 mg total Al/L). At lower pHs (< or = 5.0), H(+) was toxic to D. magna. Aluminum (1.02 mg/L) temporarily ameliorated H(+) toxicity at pH 4.5. Calcium reduced H(+) toxicity at pH 4.5. Oand Al toxicity at pH 6.5. Mortality in the presence of Al and also at low pH was associated with a net loss of Na and Cl from the daphnids. The Ca content of the daphnids was highly variable and appeared to have no pattern apart from a negative correlation with the Al content of the daphnids at pH 5.0 and 5.5. The 24-h bioconcentration ratio for Al was 10,000 at pH 6.5, 400 at pH 5.0, and negligible at pH 4.5. The rapid uptake of Al, particularly at circumneutral pHs, may be an additional source of Al for zooplanktivorous fish and other predators. (Author's abstract)

W87-00693 W87-00693

CARBON FLOW IN A TUNDRA STREAM ECO-SYSTEM.

Marine Biological Lab., Woods Hole, MA. Ecosystems Center For primary bibliographic entry see Field 5B.

W87-00701

BENTHIC BACTERIAL BIOMASS AND PRO-DUCTION IN TWO BLACKWATER RIVERS, Georgia Univ., Athens. Inst. of Ecology. For primary bibliographic entry see Field 5B.

INFLUENCE OF PH, ALUMINUM, AND OR-GANIC MATTER ON STREAM INVERTE-BRATES,

Michigan State Univ., East Lansing. Dept. of Zo-

ology.

M. Burton, and J. W. Allan.

Canadian Journal of Fisheries and Aquatic Science
CJFSBX, Vol. 43, No. 6, p 1285-1289, June 1986. 1
fig, 28 ref. DOI Grant A-120-MICH.

Descriptors: *Water pollution effects, *Acid rain, *Acid streams, *Hydrogen ion concentration, *Aluminum, *Organic matter, Aquatic animals, Invertebrates, Streams, Productivity, Toxicity.

The interactive effects of low pH, aluminum, organic matter on five species of invertebra collected from low-alkalinity (160-300 micro eq collected from low-alkalinity (160-300 micro eq/L). Michigan streams were measured using five 28-d experiments during 1982 and 1983. Such effects had not been tested previouly for these species. Each experiment consisted of a control channel (pH 7.0), a pH plus Al (250 or 500 micro g Al/L) modified channel. Three experiments were conducted using natural stream water (discoluted). iph 7.0), a pH plus Al (250 or 500 micro g Al/L) modified channel. Three experiments were conducted using natural stream water (dissolved organic carbon of 42-47 mg C/L), while two were conducted using simulated stream water with no dissolved organic carbon added. The invertebrates included Asellus intermedius Forbes, Pycnopsyche guttifer (Walker), Lepidostoma liba (Ross), Nemoura sp., and Physella heterostropha (Say). Survival rate of speices was significantly decreased at pH 4 compared with controls but not at pH 5 except for Asellus (15-20% mortality). Adding 500 micro g Al/L caused significant additional mortality under some conditions for all species except Physella. Removal of organic matter from the water caused complete mortality at pH 4 for Nemoura and Asellus when 500 micro g Al/L was added and decreased survival for Pycnopsyche to less than 20%. Addition of citrates as an organic ligand reduced susceptibility to Al in the loworganic streamwater treatment. (Author's abstract) W87-00704

DIRECT AND INDIRECT EFFECTS OF LOW PH ON THE TRANSFORMATION OF DETRI-TAL ENERGY BY THE SHREDDING CAD-DISFLY, CLISTORONIA MAGNIFICA (BANKS) (LIMNEPHILIDAE),

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences. K. van Frankenhuyzen, K. G. H. Geen, and C.

Canadian Journal of Zoology CJZOAG, Vol. 63, No. 10, p 2298-2304, October 1985. 4 fig, 7 tab, 28

Descriptors: "Water pollution effects, "Hydrogen ion concentration, "Acid rain, "Acid streams, "Caddisfly, Detrital energy, Growth rates, Streams, Lakes, Ecosystems, Larvae.

Streams, Lakes, Ecosystems, Larvae.

A shredding caddisfly, Clistoronia magnifica (Banks), was used to test the hypotheses that increased acidity would reduce the transformation of detrital energy into shredder biomass by (i) reducing survival, (ii) increasing maintenance costs at the expence of growth, and (iii) reducing food quality as a result of inhibition of microbial activity on the leaf litter. Low pH reduced larval survival immediatly after hatching and during the moult from third to fourth instar. However, surviving larvae developed faster at pH 4.2-5.2 than pH 5.8-6.4 and produced larger pupae and adults. Low pH did not alter metabolic cost or ingestion rates of fourth and fifth instar larvae. Accelerated growth resulted from indirect effects of low pH on the food resource, which suggested improved nutritional quality of leaf litter conditioned at low pH. Enhanced growth of late instar larvae, however, did not compensate for the decreased survival of early instar larvae, possibly resulting in lower shredder production under acidic conditions. (Author's abstract)

TRACE METAL UPTAKE AND SODIUM REG-ULATION IN GAMMARUS MARINUS FROM METAL POLLUTED ESTUARIES IN ENG-

Maryland Univ., Solomons. Chesapeake Biological For primary bibliographic entry see Field 5B.

DISTRIBUTION OF NUCULA TURGIDA (BIVALVIA:PROTOBRANCHIA) FROM DUBLIN BAY, IRELAND, AND THE EFFECT OF SEDIMENT ORGANIC CONTENT, Trinity Coll., Dublin (Ireland). Environmental Sciences Unit.

J. G. Wilson, and C. Shelley.

Marine Biological Association of the United Kingdom Journal JMBAAK, Vol. 66, No. 1, p 119-130,
February 1986. 3 fig. 4 tab, 36 ref.

Descriptors: *Mollusks, *Dublin Bay, *Ireland, *Water pollution effects, Sediments, Organic matter, Statistical analysis, Aquatic life, Nucula, Population density, Ecological effects.

Population density, Ecological effects.

The distribution of the protobranch bivalve Nucula turgida, which is an obligate deposit freeder, was investigated in Dublin Bay, Ireland, with particular reference to the relationship with organic content of the sediment. The density contour followed closely the 1% sediment organic content contour, with a maximum at an organic content of 1.3%. However there was great variability in the relationship, and no simple correlation could be established. It is suggested that depth may also be a factor. The dispersion pattern in the field by Chi squared approximation to Fisher' Coefficient of Dispersion) was random inclined to uniform with no change in the pattern with density or animal size. It is concluded N. turgida was unable to discriminate between sediments of organic contents ranging from zero to twice natural levels (2.14%). This seems to suggest that any link between population density and sediment organic content seen in the field is not the consequence of the adult behavior patterns or preferences. (Author's abstract)

POCALITY AND SEASONALITY OF SCHISTO-SOMA MANSONI TRANSMISSION IN THE GEZIRA IRRIGATED AREA, SUDAN, Institute for Tropical Medicine, Khartoum (Sudan). Schistosomiasis Research Project. For primary bibliographic entry see Field 5G. W87-00713

ENVIRONMENTAL IMPACTS OF FOUR IN-SECTICIDES ON NON-TARGET ORGANISMS IN THE GEZIRA IRRIGATION SCHEME CANALS OF SUDAN, Blue Nile Health Project, Wad Medani (Sudan), A. A. R. A. Karim, A. A. M. Haridi, and E. A. El

Rayah.

Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 161-168, April 1985. 2 fig, 5 tab, 15 ref.

Descriptors: "Environmental effects, "Pesticide toxicity, "Insecticides, "Sudan, "Gezira, Canala, Irrigation, Endosulfan, Dimethoate, Duraban, Decamethrin, Fish, Snails, Molluska, Arthropods, Toxicity, Pesticides, Irrigation canals.

The toxic effects of the insecticides endosulfan, decamethrin, dimethoate, and dursban were studied on the aquatic fauna of some of the Gezira irrigation canals. The animal groups selected were fishes, arthropods, and snails. Endosulfan was highly toxic, particularly to Gambusia affinia, under field and laboratory conditions. All animals proved to be less sensitive to decamethrin in the field, probably because its toxicity was reduced by reaction with organic matter. However, it proved to be the most toxic chemical to all organisms in the laboratory, probably because of the presence of the solvent in the emulaifable concentrate formulation. Dimethoate had a very low toxicity to all organisms both in the field and in the laboratory. Dursban had a lower toxicity to fish than did endosulfan under laboratory conditions, but higher toxicity to arthropods and snails. In the field, the highest mortality among fish was obtained when

Group 5C-Effects Of Pollution

dursban was mixed with endosulfan. For all insecticides, fish were the least tolerant of all animals tested, followed by arthropods and then mollusks. (Author's abstract)
W87-00721

MICROBIAL RESPONSES TO SALT-INDUCED OSMOTIC STRESS: V. EFFECTS OF SALINITY ON GROWTH AND DISPLACEMENT OF SOIL

Waterloo Univ. (Ontario). Dept. of Biology. D. R. Polonenko, C. I. Mayfield, and E. B. Plant and Soil PLSOA2, Vol. 92, No. 3, p 417-425,

Descriptors: *Salt tolerance, *Microbiological studies, *Osmotic pressure, Salt balance, Soil bacteria, Microorganisms, Salinity, Soil columns, Stress, Ecological effects, Water pollution effects

Soil columns were exposed to balanced (low Na(+)) or unbalanced (high Na(+)) high-salt solutions for a period of 7 days followed by 7 days of stress relief. Total numbers of bacteria released into the perfusates rose under both types of stress, but the proportion of displaced bacteria that were viable fell significantly. Relief from both types of stress stimulated rapid increases in the number of viable micro-organisms released from soil. Examination of the soils at the end of the relief periods revealed that soils exposed to stress contained revealed that soils exposed to stress contained more viable bacteria than the non-stressed con-trols. However, high levels of balanced stress led trols. However, high levels of balanced stress led to a significant decrease in species diversity within the microbial population, but a similar effect was not observed in soils exposed to unbalanced, high Na(+) stress. This shows that while salt stress may cause a significant reduction in the number of microorganisms in a soil, a large proportion of the microbial population can rapidly adapt to marked changes in salinity. (Author's abstract) W87-00723

BLOOMS OF CYANOBACTERIA ON THE PO-

TOMAC RIVER, Purdue Univ., Lafayette, IN. Dept. of Biochemis

D. W. Krogmann, R. Butalia, and J. Sprinkle.
Plant Physiology PHPLAY, Vol. 80, No. 3, p 667-671, March 1986. 1 fig. 3 tab, 32 ref. NSF Grant

Descriptors: *Eutrophication, *Cyanophyta, *Potomac River, Washington DC, Algae, Ecosystems, Aquatic life, Ammonia, Rivers, Ecological effects, Pohick Bay, Nitrogen, Water pollution effects.

Blooms of cyanobacteria are characterized by the sudden appearance of large numbers of cells. The blooms are most obvious when the cyanobacterium is one containing gas vacuoles that allow it to concentrate at the surface of the water as a green scum to maximize light absorption for photosynthesis. Articles in Washington, DC. papers reported a controversy as to whether a bloom on the Betomne Biver was the result of numeral wasther. ed a controversy as to whether a bloom on the Potomac River was the result of unusual weather conditions or relaxed discharge standards at sewage treatment plants. Small samples of the bloom were obtained the next day, and two weeks later, at Pohick Bay Regional Park in Virginia, and were identified as the cyanobacterium Microcystis seruginosa with other organisms visible to micro-scopic examination. The cell mass persisted into the afternoon, but was gone by sunset when the cyanobacteria had left the surface and the river cyanousceria mai ent the surface and the river assumed a more normal appearance. Historical data (from local newspapers) covering 54 years of river flow measurements between 1930 and 1983, refers to algal blooms found for 11 years. In each reters to agai blooms found for 11 years. In each of these years, there were two consecutive months of very low river flow and these were usually months of low rainfall. Therefore, it seems that cyanobacteria bloom in the Potomac River when there is little rainfall and a low flow rate. However, there are other important guestions about the er, there are other important questions about the Potomac bloom. The usual impulse is to attribute the bloom to inadequate sewage treatment. Enzyme activity measurements showed no detectable nitrate or nitrited reductase in the cells collected at Pohick Bay. These enzymes were easy to

detect in cyanobacteria grown in the laboratory, in media containing nitrate as the nitrogen source. Ammonia suppresses the synthesis of the enzymes for nitrate assimilation. This enzyme activity data is consistent with the high concentration of ammonium in the river at Pohick Bay at the time of nium in the river at Pohick Bay at the time of collection and points to ammonia as principal nitrogen source of these cells. However, it seems unlikely that oxidation of the ammonia to nitrate in the sewage treatment effluent would suppress cyanobacterial blooms. Most laboratory media for the culture of cyanobacteria at high growth rates use nitrate as the nitrogen source and M. aeruginosa grows vigorously on nitrate. Thus, while the 1983 bloom used ammonia as its major source of nitrogen, it is unlikely that future blooms would be eliminated by the oxidation of ammonia to nitrate at the sewage treatment plants. (Lantz-PTT) W87-00725

INHIBITION OF CELL DIVISION BY PRO-LINE ANALOGUES: REVERSAL BY PROLINE AND HIGH SALINITY, University of Western Ontario, London. Dept. of

Plant Sciences. G. C. Vanlerberghe, and L. M. Brown. Journal of Plant Physiology JPPHEY, Vol. 123, No. 3, p 229-239, April 1986. 6 fig, 2 tab, 31 ref.

Descriptors: *Osmotic pressure, *Salt balance, *Proline analogs, *Salinity, Bacteria, Microorganisms, Ponds, Cell division, Stress, Growth, Water pollution effects.

Six proline analogs were tested for their ability to inhibit cell division in N. bacillaris at low aslinity. Two analogues, thiazolidine-4-carboxylic acid (T4C) and azetidine-2-carboxylic acid (A2C) were found to be effective inhibitors. Inhibition by 1 mM T4C was not readily reversed by L-proline while inhibition by 20 mM A2C was substantially reversed by an equimolar concentration of L-proline. Also, inhibition by T4C was partially reversed by L-asparagine and L-glutamine and inhibition due to A2C by L-alanine and L-glutamine. When cells were grown in high salinity media, sensitivity to inhibition by T4C increased. Conversely, A2C became ineffective as an inhibitor of cells at high salinity. Since N. bacillaris accummulates high intracellular concentrations of free proline when grown at high salinity, the reversal of inhibition by A2C at high salinity may have been due to the high intracellular pool of proline in such cells. (Author's abstract) (Author's abstract)

PHYSIOLOGICAL ECOLOGY OF THE BLOOM-FORMING ALGA CHRYSOCHRO-MULINA BREVITURRITA (PRYMNESIOPHY-CEAE) FROM LAKES INFLUENCED BY ACID PRECIPITATION, University of Western Ontario, London. Dept. of

J. D. Wehr, L. M. Brown, and K. O'Grady. Canadian Journal of Botany CJBOAW, Vol. 63, No. 12, p 2231-2239, December 1985. 12 fig. 8 tab,

Descriptors: *Physiological ecology, *Algae, *Chrysochromulina, *Lakes, *Acid rain, *Eutrophication, *Ontario, *Water pollution effects, Odors, Odor-producing algae, Algal growth, Hydrogen ion concentration, Growth.

Many aoft-water lakes in northeastern North America subject to acid precipitation have been affected by lakewide odors associated with blooms of the greenish-gold alga, Chrysochromulina breviturrita (Prymnesiophyceae). This study was undertaken to establish an axenic unialgal culture of C. breviturrita, develop an ecologically realistic growth medium which will sustain long-term growth, and determine some of the physicochemical factors controlling algal growth, especially pH tolerance. The alga was isolated from Cinder Lake, Ontario into axenic culture and maintained in a tolerance. In eaga was soluted from Cinder Lake, Ontario into axenic culture and maintained in a chemically defined medium corresponding to the hemistry of acidified lakes. The medium devel-oped, Muskoka No. 42, is described and compared with the average water chemistry of affected lakes. The pH tolerance range was determined to be 4.0-

6.9, with an optimum of 5.5-6.9; the alga was unable to survive above neutrality. Additions of bicarbonate ion at 100 micro-M or greater completely inhibited growth. Nutritional studies augpletely inhibited growth. Nutritional studies sug-gested an inability to grow on any nitrogen source other than ammonium ion. The alga also was found to require the vitamins B12 and thiamine, but not biotin. This is the first instance of a freshwater member of the Prymnesiophyceae axenically main-tained in a defined medium. (Doria-PTT) W87-00756

AGEING OF BLEACHED KRAFT MILL EF-FLUENT STUDIED BY DEGRADATION OF CHLORINATED PHENOLIC COMPOUNDS AND SELENASTRUM ALGAL ASSAYS, Jyvaeskylae Univ. (Finland). Dept. of Biology. For primary bibliographic entry see Field 5B. W87-00769

EFFECT OF SUGAR MILL EFFLUENT ON ENZYME ACTIVITIES OF RICE SEEDLINGS, Jawaharlal Nehru Univ., New Delhi (India). School of Life Sciences. B. K. Behera, and B. N. Misra. Environmental Research ENVRAL, Vol. 37, No. 2, p 390-398, August 1985. 4 fig, 19 ref.

Descriptors: *Effluents, *Sugar mills, *Enzym *Water pollution effects, Toxicity, Rice, Industri wastes, Food-processing wastes.

A correlation has been established between the retardation of growth and development of rice seedlings treated with sugar mill effluent and the activities of some key enzymes regulating growth and development. The activity of rice seedling peroxidase, amylase, and nitrate reductase deand development. The activity of rice seedling peroxidase, amylase, and nitrate reductase decreased during effluent treatment, possibly due to the presence of large amounts of various cations and anions in the effluent. High concentrations of ammonia would have stimulated nitrate reductase activity, which, however, decreased significantly. High chloride concentrations resulted in loss of nitrate reductase activity in root and shoot extract; the chloride may be active as a direct porspecific nitrate reductase activity in root and shoot extract; the chloride may be acting as a direct nonspecific inhibitor of proteosynthesis on ribosomes or indirectly by decreasing nitrate absorption. Succinate dehydrogenase (SDH) activity increased nearly threefold at various concentrations of effluent treatment, followed by a rapid loss after 12 hours. Stimulation of SDH activity may be caused by the large amounts of ammonia in the effluent. Lyssomal enzymes released by the large amounts of cations and anions in the effluent may disrupt mitochondrial membranes, causing the subsequent cauous and amons in the entluent may disrupt mitochondrial membranes, causing the subsequent decrease in SDH activity. In general, it is suggested that changes in enzyme activities result from ion-induced denaturation and the among deposited salts. (Doria-PTT)

W87-00791

HYDROGEN ION BUFFERING OF CULTURE MEDIA FOR ALGAE FROM MODERATELY ACIDIC, OLIGOTROPHIC WATERS, University of Western Ontario, London. Dept. of Plant Sciences. For primary bibliographic entry see Field 2H.

IRON-MEDIATED CHANGES GROWTH OF LAKE ERIE PHYTOPLANKTON
AND AXENIC ALGAL CULTURES, State Univ. of New York Coll. at Fredonia. Environmental Resources Center.
For primary bibliographic entry see Field 2H.
W87-00801

SUBLITTORAL MACROBENTHIC COMMUNITY STRUCTURE OF AN IRISH SEALOUGH: EFFECT OF DECOMPOSING ACCU-MULATIONS OF SEAWEED,
University of East Anglia, Norwich (England).
School of Biological Sciences.
For primary bibliographic entry see Field 2L.
W87-00804

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

GROWTH RESPONSE OF YELLOW-POPLAR (LIRIODENDRON TULIPIFERA L.) SEED-LINGS TO OZONE, SULFUR DIOXIDE, AND SIMULATED ACIDIC PRECIPITATION, ALONE AND IN COMBINATION, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Plant Pathology and Physiology. A. H. Chappelles, B. I. Chevone, and T. E. Burk. Environmental and Experimental Botany EEBODM, Vol. 25, No. 3, p 233-244, August 1985. 2 fig, 4 tab, 39 ref. 1985. 2 fig, 4 tab, 39 ref.

Descriptors: *Growth, *Ozone, *Sulfur dioxide, *Acid rain, *Air pollution effects, *Yellow-Poplar trees, Sulfur compounds, Air pollution, Hydrogen ion concentration, Water pollution effects, Chloro-

Nine-week-old yellow-poplar were exposed to O3 and/or SO2 in combination with simulated rain for 6 weeks with rain applied either just before or after fumigation. Across all rain treatments, O3 + SO2 resulted in a significant decrease in growth and dry matter production and an increase in leaf area ratio matter production and an increase in Jens are ratio (LAR) compared with controls. The combined effect of O3 and SO2 was additive or greater. A significant gaseous pollutant x rain pH interaction occurred for root dry weight, leaf area increase, mean relative growth rate (RGR), mean unit leaf rate (ULR), and chlorophyll content. Ozone exposure resulted in a linear decrease in root dry weight, leaf area increase, RGR, and ULR, as the acidity of rain increased, whereas fumigation with SO2 resulted in an increase in these growth variables as rain pH decreased. Chlorophyll content increased in both O3 and SO2 treatments as the acidity of rain increased. Fumigation of wet leaves caused a significant reduction in dry matter production, shoot elongation, leaf area, RGR, and ULR as compared with dry leaves across all treatments. The results of this study demonstrate that ments. The results of this study demonstrate that the effects of multiple pollutant stresses are more deleterious than any single pollutant exposure for these trees. (Author's abstract)
W\$7-0808

ANALYSIS, ACCUMULATION AND CENTRAL EFFECTS OF TRIHALOMETHANES. I. BRO-

MOFORM, Instituto de Quimica Bio-Organica, Barcelona (Spain). P. Parra, E. Martinez, C. Sunol, F. Artigas, and J. M. Tusell.

Toxicological and Environmental Chemistry TXECBP, Vol. 24, No. 2, p 79-91, 1986. 4 fig. 4

Descriptors: *Trihalomethanes, *Drinking water, *Barcelona, *Spain, *Bioaccumulation, *Neurotoxicity, Bromoform, Rats, Metabolic activity, Central nervous system, Chromatography.

The effects of organic micropollutants on the central nervous system of the rat, were investigated using bromoform as the model pollutant because it using oromotorm as the model politicant occase it is found in high concentrations in the Barcelona drinking water supply. Chromatographic analysis showed that bromoform accumulated in rat brain, kidney and fat, in increasing order and was rapidly eliminated after 30 minutes. Increased metabolic activities and detected that could be set increased. activity was detected that could be attributed to an increased nervous activity, stimulating the metabolism of serotonin, or to its greater degradation. (Peters-PTT) W87-00831

5D. Waste Treatment Processes

TERTIARY TREATMENT OF SECONDARY EFFLUENT BY DISSOLVED AIR FLOTATION

EFFLUENT BY DISSOLVED AIR FLOTATION AND FILTRATION (SANDFLOAT) SYSTEM, Krofta Engineering Corp., Lenox, MA.

M. Krofta, and L. K. Wang.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-171165, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No. LIR/12-82/2, December 6, 1982. 23 p, 3 fig, 4 tab. Contract No. L8110031.

Descriptors: *Secondary wastewater treatment, *Effluents, *Dissolved air flotation, *Sandfloat

system, *Tertiary wastewater treatment Wastewater treatment, Filtration, Process contro Flotation, Municipal wastewater, Industria wastewater, Lenox, Massachusetts. Industrial

An innovative Sandfloat system has been designed and developed for tertiary treatment of municipal secondary effluent. The new process system consists of two important unit processes: dissolved air flotation and filtration. This report introduces the Sandfloat plant's special engineering features, technology status, process performance, process limitations, chemical requirements, residual generation, design criteria, process reliability, and environmental impact. Based on technical data from the U.S. Environmental Protection Agency, the treatment efficiency of a flotation/filtration system for removal of BOD, COD, TOC, TSS, oil and grease, total phosphorus, phenols, cyanides, various toxic moval of BOD, COD, TOC, TSS, oil and grease, total phosphorus, phenols, cyanides, various toxic heavy metals, and toxic organics is compiled and documented. In addition to tertiary treatment of municipal effluent, Sandfloat plant can also be used for municipal water treatment, industrial water treatment, industrial water treatment, pretreatment of reverse osmosis influent, and pretreatment of carbon adsorption influent. A full scale one MGD Sandfloat plant serving 6500 residents in the Town of Lenox, MA, is also described. (Author's abstract)

ANAEROBIC TREATMENT OF GASIFIER EF-FLUENTS, Georgia Inst. of Tech., Atlanta. W. H. Cross, E. S. K. Chinn, F. G. Pohland, M. Giabbai, and S. R. Harper. Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-001864, Price codes: A02 in paper copy, A01 in microfiche. Report No. DOE/FC/10297-T4, September 1982. 10 p, 3 fig, 12 tab.

Descriptors: *Anaerobic digestion, *Gasification, *Effluents, Wastewater treatment, Total organic carbon, Chemical oxygen demand, Phenols, Methane, Activated carbon, Nitrification.

The major efforts of this study have been directed The major efforts of this study have been directed toward the reacclimation of two anaerobic treatment systems, continued steady state operation of a third system at an approximately 10% raw wastewater loading, and operation of a nitrification system on full strength effluent from the third anaerobic treatment system. System efficiency has remained fairly good with average removal over 90 days being 42.0%, 44.4% and 60.9% for total organic carbon (TOC), chemical oxygen demand (COD), and phenol, respectively. Gas production has remained relatively high with an average production of 6.6 1/day and a methane content of 77.2%. However, close examination of the data indicates a very slight but steady decrease in per-77.2%. However, close examination of the data indicates a very slight but steady decrease in performance based on phenol removal, both overall and especially in the activated carbon column. Removal of residual TOC, COD, TKN and NH3-N were all excellent. The system is still being operated in order to furnish a nitrified waste for a planned denitrification system to be put in operation in the near future. The progress of these efforts along with project expenditures for the above contract are presented in detail. (Lantz-PTT)

PLATING WASTES SURVEY, Army Mobility Equipment Research and Develop-ment Command, Fort Belvoir, VA. Energy and Water Resources Lab.

Water Resources Lab.
P. G. Chesler.
Available from the National Technical Information
Service, Springfield, VA. 22161, as Ad/A125 230,
Price codes: A04 in paper copy, A01 in microfiche.
Report No. 2374, November 1982. 64 p, 9 fig, 3

Descriptors: *Wastewater treatment, *Metal-finishing wastes, *Surveys, Electroplating, Industrial wastewater, Heavy metals, Chrome, Anodizing.

Twenty-three DARCOM installations perform plating and other metal finishing operations cov-

ered by EPA's Plating Wastewater Pretreatment regulations. Wastewater flows vary from less than 100 gallons/day to over 150,000 gallons/day. Treatment methods vary widely. New, sophisticated treatment plants are being installed in several locations. Other plants are expanding their wastewater treatment capacity. One plant will soon include a chrome recovery unit in the plating shop. DARCOM installations plate a large number of different metals. Research and development centers typically have the capability to plate all of the usual metals; a few plants plate only one metal or confine their activity to one process, such as anodizing. In many cases, common problems exist. Disposal of sludges and concentrated process solutions are becoming more costly and time-consuming. Rinsewater volume controls in the plating shop are seldom satisfactory. The organizational structure at most DARCOM installations places control of treatment needs and responses in more than one person, making coordination difficult. In this report, the similarities and differences reported by the 23 installations are described, providing a data base of DARCOM plating wastewater treatment. Subjects discussed include the variety in metals plated, volumes of wastewater flow, and efficiency of operations. Similarities are noted in basic treatment methods, in lack of recycle and recovery systems, and in problem areas. Actual DARCOM plating wastewater treatment is described. Problems and successes of these shops are cited. Where appropriate, conclusions are drawn and suggestions are made. (Author's abstract)

DESIGN AND INSTALLATION OF MOUND SYSTEMS FOR WASTE TREATMENT, North Carolina State Univ. at Raleigh. Dept. of

Soil Science. C. Cogger, B. L. Carlile, D. Osborne, and E. A. Holland.

Holland.

Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-167031, Price codes: Ad2 in paper copy, Ad2 in microfiche. UNC Sea Grant College Publication UNC-SG-82-04, August 1982. 31 p, 14 fig, 5 tab, 5 append. Grant No. 04-6-158-44054.

Descriptors: "Mound systems, "Wastewater disposal, "Wastewater treatment, "Design standards, Land disposal, Absorption, Permits, Sewer systems, North Carolina.

Many sites under consideration for development in North Carolina are not suitable for on-site sewage disposal by conventional septic systems. Among these sites are some which do have enough depth and area of usable soil to provide safe disposal via mound systems. Mounds are not a panacea for all the unsuitable soils of North Carolina, but they are the unsuitable soils of North Carolina, but they are useful for some specific conditions where conventional systems have frequently failed. This manual specifies the procedures and materials to be used for successful siting, design, installation and maintenance of residential mound systems. Use of proper materials and techniques is critical to the success of the mound, as well as to all other ground-absorption systems. Many engineers, sanitarians, contractors and designers are unfamiliar with mound construction, and these instructions are designed as an aid to them. Although those who design, build and use septic systems can benefit from this report, it must always be used in cooperation with the local health department. The nt from this report, it must always be used in cooperation with the local health department. The local health department must first approve a site, and then assign waste flow and soil loading rates. This manual covers design and installation of small mound systems suitable for homes and small busi-nesses. Principles are similar for larger commercial and institutional systems, but the special require-ments of those systems are not addressed. (Au-thor's abstract) thor's abstract) W87-00077

DISCHARGE OF TREATED SEWAGE TO GROUNDWATER USING THE HYDRAULIC CRITERIA FOR SLOW SAND FILTRATION, Instituut voor Milieuhygiene en Gezondheidstech niek TNO, Delft (Netherlands).

For primary bibliographic entry see Field 5E.

Group 5D—Waste Treatment Processes

W87-00129

WASTE DISPOSAL IN SCOTLAND AND ITS EFFECTS ON GROUND AND SURFACE WATERS,

Forth River Purification Board, Edinburgh (Scot-

land). M. P. Henton

M. P. Henton.
IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 183-191, 2 fig.

Descriptors: *Waste disposal, *Scotland, *Ground-water pollution, Water pollution effects, Surface water, Groundwater, Geology, Landfills, Water

Scotland has numerous natural factors such as climate and geology that help to determine the pattern of waste disposal and the amount of leachate that arises from landfills. This pattern is not necessarily the same as that prevailing in England and Wales, and an explanation of the factors behind Wales, and an explanation of the factors behind these differences is given. A study was undertaken into the extent of the surface and groundwater pollution that exists as a result of waste disposal, and this is reviewed. The ways in which water pollution from landfills can be prevented or miti-gated is discussed using relevant examples from Scotland and brief mention of the slightly different way which the Control of Pollution Act operates in Scotland in made. While referring specifically Scotland and other Control of Pollution Act operates in Sootland is made. While referring specifically to the Scotland is tuation, the points raised within this paper do, of course, have relevance throughout the United Kingdom. (See also W87-00127) (Author's

LEACHATE COLLECTION SYTEMS. CH2M Hill, Newport Beach, CA.
For primary bibliographic entry see Field 5E.
W87-00226

WATER SUPPLY AND SANITATION IN THE SOUTHEAST-ASIA REGION, World Health Organization, New Delhi (India). Regional Office for South-East Asia. For primary bibliographic entry see Field 5F. W87-00245

INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE PRO-GRAMME IN THE PHILIPPINES, Ministry of Health, Manila (Philippines). For primary bibliographic entry see Field 5F. W87-00248

HEALTH EFFECTS AND IMPACT OF WATER SUPPLY AND SANITATION, Andrija Stampar School of Public Health, Zagreb (Yugoslavia). For primary bibliographic entry see Field 5F. W87-00249

TWO APPROACHES TO MODELING KINET-ICS OF BIODEGRADATION BY GROWING CELLS AND APPLICATION OF A TWO-COM-PARTMENT MODEL FOR MINERALIZATION

PARIMENT MODEL FOR MINERALIZATION KINETICS IN SEWAGE,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
S. Simkins, R. Mukherjee, and M. Alexander.
Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 6, p 1153-1160, June 1986.
4 fig. 2 tab, 15 ref. Public Health Service Training Grant ES-07052.

Descriptors: *Biodegradation, *Mineralization kinetics, *Sewage, *Glucose, *Microbial degradation, *Benzoate, *Phenol, *Mathematical models, Bacterial physiology, Monod equations, Nonlinear

The patterns of microbial mineralization of 0.3 to 30 nanograms of glucose, benzoate, and phenol per

ml of sewage collected in late fall and winter were analyzed with the integrated Monod equation and a model in which growth of active organisms occurs at the expense of organic compounds other than the test substrate. Either model could be occurs at the expense of organic compounds other than the test substrate. Either model could be closely fit by nonlinear regression to the data from individual tests with one concentration of substrate added to one dilution of sewage. However, neither model accounted satisfactorily for differences in patterns of mineralization resulting from differences in substrate concentration and cell density between different tests. It is suggested that both the added substrates and other organics present in sewage contributed to the growth of the active organisms. The mineralization of glucose in sewage collected in summer was described better by a two-compartment model than by any other by a two-compartment model than by any other model tested. (Author's abstract) W87-00253

ACTIVATED SLUDGE MODEL WHICH CON-SIDERS TO NICANT CONCENTRATION: SIM-ULATION AND SENSITIVITY ANALYSIS, Auburn Univ, AL. Dept. of Civil Engineering. L. Benefield, and R.B. Reed. Applied Mathematical Modelling, Vol. 9, No. 6, p 454-465, December 1985. 5 fig. 4 tab, 9 ref, append.

Descriptors: *Waste treatment, *Wastewater treatment, *Mathematical models, *Activated sludge, *Toxicant concentration, Sludge, Poisons, Hazardous materials, Toxicity, Toxins, Wastewater.

A mathematical model was developed which described organic removal, oxygen utilization, ammonia-nitrogen removal, ortho-phosphate removal and biomass production in an aggregated microbial suspension. The suspension was of uniform floc size containing organics as a soluble biodegradable material and toxicants. The model was applicable to both steady-state and transient conditions as well as to externs experiencing only carbon oxidawell as to systems experiencing only carbon oxida-tion or both carbon oxidation and nitrification. It is tion or both carbon oxidation and nitrification. It is comprised of five partial differential equations and four ordinary differential equations, and took into account the flow pattern in the reactor; intraparti-cle mass transport of oxygen, organics, ammonia-nitrogen and orthophosphate; biochemical reac-tions by individual cells embedded in the floc; and tions by individual cells embedded in the floc; and toxicity effects on cellular reactions. In developing the model, it was assumed that a lack of either organics, oxygen, ammonia-nitrogen, ortho-phophate or any combination of these nutrients could limit the overall rate of the process and that the presence of toxicants could also limit the rate of the process. A sensitivity analysis performed on this model indicated that the single most important factor in determining model output was the retention time in the reactor. The second most important factor was the floc radius. (Author's abstract) W87-00294

WASTEWATER TREATMENT, Vanderbilt Univ., Nashville, TN. Dept. of Envi-ronmental and Water Resources Engineering. W. W. Eckenfelder, J. Patoczka, and A. T. Watkin.

Watkin.
Chemical Engineering, Vol.92, No.18, p 60-74,
September 2, 1985. 15 fig, 8 tab, 20 ref.

Descriptors: *Wastewater treatment, *Water pretreatment, *Effluent, Water reuse.

Effluent limits have become stricter in recent years, causing the chemical process industries to upgrade their wastewater-treatment systems and build new ones. Before 1972, limits in the U.S. build new ones. Before 1972, limits in the U.S. applied only to soluble organics, suspended solids, and pH, plus a few specific chemicals and metals, and a plant could meet those limits by biologically treating its wastewaters. But now the limits on those pollutants are tighter. To meet these limits on those pollutants are tighter. To meet these limits and plants have to employ sophisticated chemical and physical processes because biological treatment alone is not adequate. Chemical process industry wastewaters have to be treated before they can be released or reused. Some can be treated by convenienced to the convenience of the con wastewaters have to be made and be treated by conventional processes such as sedimentation, flotation and biological treatment. However, it may be necessary ary to pretreat certain streams (e.g., to remove ic organics) and to polish the effluent by such

methods as adsorption or oxidation. (Khumbatta-PTT) W87-00300

GLYPHOSATE-DEGRADING MICROORGANISMS FROM INDUSTRIAL ACTIVATED SLUDGE, Monsanto Agricultural Products Co., St. Louis,

T. M. Balthazor, and L. E. Hallas.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 432-434, February 1986. 2 fig, 1 tab, 10 ref. Microbiology

Descriptors: *Glyphosate, *Industrial wastes, *Activated sludge, Herbicides, Bacteria, Plating medium, N-phosphonomethylglycine, Flavobacter-

N-phosphonomethylglycine (glyphosate) is a widely used broad-spectrum herbicide. The microbial characterizations and modeling of glyphosate-degrading activity are under study to establish activated studge as the best available technology to meet EPA pesticide effluent guidelines. A plating medium was developed to isolate glyphosate-degrading microorganisms, with glyphosate as the sole phosphorus source. Two industrial biosystems treating glyphosate wastes contained elevated misole phosphorus source. I wo industrial biosystems treating glyphosate wastes contained elevated microbial counts on the medium. One purified isolate metabolized glyphosate to aminomethylphosphonic acid, mineralizing this accumulating intermediate during log growth. This microorganism has been identified as a Plavobacterium species. W87-00305

TRACE ORGANICS IN SEPTIC TANK EFFLU-

Regina Univ. (Saskatchewan). Faculty of Engineering. For primary bibliographic entry see Field 5B. W87-00333

COPPER SPECIES IN AQUEOUS SEWAGE SLUDGE EXTRACT,

Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water. U. Mingelgrin, and J. W. Biggar. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 351-359, April 1986. 1 fig, 2 tab, 29 ref.

Descriptors: *Copper, *Sludge, *Wastewater, *Groundwater pollution, Electrophoresis, Complexation, Saturation extract, Plants, Groundwater, California, Davis, Yolo silt loam.

The Cu in the saturation extract of dried sewage sludge from Davis, CA was mainly in a complexed form. A Cu(2+) specific ion electrode was used to determine the extent of complexation. The adsorption coefficient for the complexed Cu on Yolo silt loam was 4 while for Cu added as CuSO4 it was 90 L/kg at relevant Cu concentrations in solution. Paper electrophoresis was used to define the Cu in the sludge which was water soluble increased significantly upon drying. The large percentage of complexed Cu complexes according to their mobility in an electric field. Six fractions of positive, negative and neutral charge were isolated. The portion of Cu in the sludge which was water soluble increased significantly upon drying. The large percentage of complexed C and its relatively low adsorption on soil suggested that sewage sludge may, under certain conditions, be a source of Cu contamination of plant systems and of ground water. (Alexander-PTT)

RECOVERY OF BENTHIC INVERTEBRATE COMMUNITIES IN SILVER BOW CREEK, MONTANA, FOLLOWING IMPROVED METAL MINE WASTEWATER TREATMENT,

Chadwick and Associates, Littleton, CO. J. W. Chadwick, S. P. Canton, and R. L. Dent. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 427-438, April 1986. 4 fig. 4 tab, 16 ref.

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Descriptors: *Wastewater treatment, *Mine treatment, *Benthic fauna, *Invertebrates, Stream biota, Aquatic life, Metal mines, Montana, Silver Bow

Silver Bow Creek, a tributary of the Clark Fork River in southwest Montana, has been affected by metal and domestic wastes for >100 yr. The invertebrate community was monitored at five stations from 1972 through 1983 to determine both the longitudinal and temporal patterns of recovery following major improvements in mine wastewater treatment. This treatment dramatically reduced metal concentrations in the discharge. Despite markedly improved water quality, no invertebrates were collected in Silver Bow Creek until 1975, when small numbers of invertebrates (primarily chironomids) were found at the furthest downstream stations. A few invertebrates (<75/sq m) were collected for the first time at stations 1 and 2 in 1981, although the lower stations still had much greater densities (>1600/sq m). The earliest colonizers at each station were chironomids, empidids, and oligochaetes. In 1982, 10 yr after initiation of improved water quality, aquatic insect populations were over 1800/sq m at all five stations. Populations dropped in 1983, but upper and lower stations had comparable densities suggesting that the stream is responding to a common stress such as high snowmelt runoff. The relatively long recovery time is partially attributed to lack of an undisturbed headwater source of colonizers. (Author's abstract)

SECONDARY WASTE TREATMENT: AERO-BIC BACTERIAL ACTIVITY, INITIAL AND RESIDUAL RESPIRATORY PHASES, Merrimack Waste Treatment Facility, NH. F. S. Schlenker.

Water, Air, and Soil Pollution WAPLAC, Vol. 29, No. 1, p 85-92, May 1986. 4 fig, 1 tab, 7 ref.

Descriptors: *Wastewater treatment, *Secondary wastewater, *Biodegradation, Aerobic bacteria, Bacteria, Organic matter, Respiration.

Secondary waste treatment is based on aerobic bacterial activity. Two fractions are involved, soluble and insoluble organic matter. This study ascertained whether the major portion of bacterial activity is a function of specifically located aeration tank sites, of limited volume, or requires the total aerated capacity and the longer detention times. To distinguish between these two possibilities, an aeration tank was partitioned into hypothetical subvolumes adjacent to the influent ports. These are the initial respiratory spaces, constituting the respiratory phase of secondary treatment. The remainder of the aerated systems activity occurs in the residual respiratory space. (Master-PTT)

ANILINE AND ANILINIUM ION OZONATION IN AQUEOUS SOLUTION, Naples Univ. (Italy). Ist. di Chimica Industriale e Impianti Chemici.

Impianti Chemici.
V. Caprio, and A. Insola.
V. Caprio, and A. Insola.
Ozone Science and Engineering OZSEDS, Vol. 7,
No. 3, p 169-179, Summer 1985. 4 fig, 17 ref.

Descriptors: *Aniline, *Wastewater treatment, *Ozonation, Anilinium, Electrophilic ozonolysis.

The ozonation, Anumum, Electrophilic ozonolysis. The ozonation of aniline and anilinium ion in aqueous solutionwas investigated by determining the product distributions at different degrees of ozonation. Results indicate that anilinium ion, although less reactive than aniline, has a remarkable reactivity towards ozone. The high anilinium ion reactivity and the observed product distributions are explained by assuming a radical mechanism for anilinium ion ozonation, the behavior of aniline appears to be regulated mainly by the electrophilic ozonolysis mechanism. In wastewater treatment systems, aniline is usually removed by liquid-liquid extraction or steam distillation. These procedures are convenient for reduction of COD levels to not lower than 1,000 mg/L. More effective treatment methods are required to attain higher degrees of purification. (Peters-PTT)

W87-00387

UPTAKE OF PHOSPHORUS AND NITROGEN BY MYRIOPHYLLUM AQUATICUM (VEL-LOZA) VERD, GROWING IN A WASTEWATER TREATMENT SYSTEM, Dandenong Valley Authority (Australia). P. M. Nuttall.

P. M. Nuttali. Australian Journal of Marine and Freshwater Re-search AJMFA4, Vol. 36, No. 4, p 493-507, Octo-ber 1985. 6 fig. 4 tab, 28 ref. Australian Water Resources Council Project No. 806139.

Descriptors: *Wastewater treatment, *Secondary wastewater, *Macrophytes, *Phosphorus, *Nitrogen, Aquatic plants, Wastewater lagoons, Suspended solids, Biochemical oxygen demand.

The potential of the aquatic macrophyte M. aquaticum to remove nitrogen and phosphorus from secondarily treated wastewater effluent was investigated over 13 months. The flow-through wastewater treatment system consisted of three separate lagoons, the first lagoon with a floating mat of aquatic plants, the second with aquatic plants and aerated, and the third with aquatic plants under a polythene canopy and aerated. The aerated, canopy-covered lagoon was more efficient than the two other lagoons at removing influent ammonia-nitrogen, total nitrogen, total phosphorus, suspended solids, and biochemical oxygen demand. (Master-PTT)

APPLICATION OF DISSOLVED AIR FLOTA-TION TO THE LENOX, MASSACHUSETTS WATER SUPPLY: SLUDGE THICKENING BY FLOTATION OR LAGOON, Lenox Inst. for Research, Inc., MA. For primary bibliographic entry see Field 5F. W87-00402

DEVELOPMENT AND ANALYSIS OF EQUALIZATION BASINS,
Georgia Inst. of Tech., Atlanta. School of Civil JOURNAI of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 6, p 907-922, December 1985. 7 fig, 9 ref.

Descriptors: *Equalization basins, *Wastewater treatment, *Mathematical models, Design.

Adequate control of wastewater treatment processes with variable input parameters can be achieved through the employment of equalization basins. Variability of input and output parameters are analyzed, and mathmatical modes of conventional and new configurations of equalization basins describing the propogation of regualar and random input signals are presented. Comparison of certain designs of equalization basins are more efficient than one-channel tanks (complete mix, m-tanks in series, or diffused flow). A substantial advantage of new basin types is in that they can be tuned to the particular spectrum of incoming fluctations. (Master-PTT)

SIMULATION OF MEMBRANE PROCESSES CONCENTRATING INDUSTRIAL EF-

Manhattan Coll., Bronx, NY. Dept. of Chemical Engineering. C. S. Slater, J. M. Zielinski, and R. G. Wendel. A.IChE Symposium Series, Vol. 82, No. 248, p 98-107, 1986. 12 fig. 19 ref.

Descriptors: *Effluents, *Membrane processes, *Industrial wastewater, *Wastewater treatment, Reverse osmosis, Simulation analysis, Membrane

The process parameters of a small reverse osmosis system concentrating industrial wastewater in a closed-loop operation have been studied. A simulation model was developed and utilized for concentrating a simple salt. The results were compared to

the experimental data of an inorganic chemical effluent in order to examine variations from model behavior. Simulation of a simple salt system can be utilized to predict industrial wastewater processing trends and deviation due to non-ideal mass-transfer. Two deviations from model behavior were evident in concentrating the inorganic wastewater: solute rejection and water flux were lower than the model predicted. The initial deviations were due to the actual osmotic pressure to solute concentration ratio and the solute permeability coefficient of the inorganic wastewater being slightly higher than the simple salt. The presence of concentration parization and fouling in treating the industrial effluent were the major factors attributing to deviations from the simulation model. (McFarlane-PTT) PTT) W87-00483

REUSING POWER PLANT COOLING WATER TO REDUCE MAIN BREAKS, Manitowoc Public Utilities, WI. For primary bibliographic entry see Field 3E.

NITROGEN REMOVAL IN RAPID FILTRA-TION SYSTEMS

Nolte (George S.) and Associates, Sacramento, CA. R. W. Crites.

Journal of Environmental Engineering, (ASCE) JOEEDU, Vol. 111, No. 6, p 865-873, December 1985. 5 tab, 17 ref.

Descriptors: *Infiltration, *Nitrogen removal, *Wastewater treatment, Rapid infiltration, Infiltration rate, Nitrogen, Phosphorus, Hydraulic loading, Phosphorus removal, Nitrification, Denitrifi-

cation.

Rapid Infiltration (RI) Systems, also known as the Soil-Aquifer Treatment System, for wastewater treatment and disposal can be designed rationally based on measured infiltration rates and treatment requirements. The hydraulic loading rate is determined using a percentage of the designed infiltration rate. The percentage varies from 2-10%, deepending on the nature of the field test for infiltration rate, the variability of the site soils, and the ratio of application period to drying period. Wastewater treatment by rapid infiltration relies upon intermittent applications. Removal of BOD, suspended solids, heavy metals, bacteria and viruses only occurs in the top few inches of soil. Removal of nitrogen occurs as a result of the Nitrification/Denitrification process. Phospi-orus removal occurs as percolate flows through the soils and groundwater aquifer. The hydraulic loading also affects the treatment efficiency for nitrogen and phosphorus. (Jessick-PTT)

PHOSPHORUS REDUCTION FOR CONTROL

GKY and Associates, Inc., Springfield, VA. For primary bibliographic entry see Field 4A. W87-00515

PUMPED WASTEWATER COLLECTION SYS-TEMS OPTIMIZATION, Indian Inst. of Tech., Bombay. Centre for Envi-ronmental Science and Engineering. V. S. Kulkami, and P. Khanna.

JOEEDU, Vol. 111, No. 5, p 589-601, October 1985. 5 fig, 11 tab, 8 ref.

Descriptors: *Algorithms, *Mathematical studies, *Optimization, *Wastewater collection, *Pumping, Cost analysis, Case studies, Design criteria.

An optimization algorithm was developed for the An opumization agoritam was developed for the design of gravity-cum-pumped wastewater collection systems with recourse to dynamic programing. The alogrithm minimizes the problem of dimensionality through cost effective feasible groupings at junction manholes and with division of the algorithm into two parts. The first part

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identifies optimal control variables associated with each link and stores the same while the second part uses these stored values along with input data to prepare detailed hydraulic and cost statements. The effectiveness of the algorithm was tested in two case studies. Incorporation of intermediate pumping in wastewater water collection systems resulted in savings of 7.75-28% over complete gravity optimal systems. Higher savings have been achieved in cases where the intermediate pumping station solution, identified in the optimization process, could be adopted on-site. (Geiger-PTT)

GENERATING DESIGNS FOR WASTEWATER

Missouri Univ.-Rolla. Dept. of Civil Engineering. Name of Control of Civil Engineering. S. -Y. Chang, and S. -I. Liaw. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 5, p 665-679, October 1985. 4 fig, 6 tab, 37 ref.

Descriptors: *Design criteria, *Wastewater treat-ment, *Optimization, *Models, *Cost analysis, Computer models, Mathematical models, Compari-son studies, Wastewater facilities.

Optimization models may be more useful in the design of wastewater treatment systems if they can be used to generate good but different design alternatives for evaluation. A study was conducted to examine two modeling-to-generate-alternatives (MGA) methods (the generating and screening method and the efficient random generation method) for the purpose of generating good and different preliminary designs for a typical wastewater treatment system design problem. The results showed that various designs, which are good with respect to the objectives specified but widely different with respect to the treatment processes, could be generated by the two MGA methods. In comparing the alternatives generated by the two methods with those derived from the original optimization model and a constraint method, it was found that the MGA methods were more effective in developing various preliminary mentod, it was round that the NOA methods were more effective in developing various preliminary wastewater treatment system designs which not only meet minimal requirements but also are widely different from each other. (Geiger-PTT)

STOCHASTIC OPTIMIZATION/SIMULATION OF CENTRALIZED LIQUID INDUSTRIAL

OF CENTRALIZED LIQUID INDUSTRIES.
WASTE TREATMENT,
Johns Hopkins Univ., Baltimore, MD. Dept. of
Geography and Environmental Engineering.
J. H. Ellis, E. A. McBean, and G. J. Farquhar. Journal of Environmental Engineering (ASCE) JOEEDU, Vol 111, No. 6, p 804-821, December 1985. 3 fig. 5 tab, 22 ref, 3 append.

Descriptors: *Stochastic process, *Mathematical models, *Wastewater treatment, *Industrial wastes, *Optimization, Simulation analysis, Cost analysis, Mathematical studies, Models, Probabilistic process, Water quality standards, Performance

evaluation.

A stochastic optimization-simulation method is presented for delineating least-cost treatment sequences for a centralized liquid industrial waste treatment facility. A dynamic programming model performs the optimization. The function of the model is to delineate least-cost treatment sequences that will produce an acceptable effluent stream quality given a probabilistically-generated influent waste regime. The model is structured to permit the following user-determined options: waste type; contaminant-specific probability density functions for waste strength; unit treatment processes including performance efficiencies and related costs; and individual contaminant effluent standards. The stochastic dynamic programming model served as a screening device, identifying unit treatment processes and sequences of processes with favorable cost-effectiveness attributes. The treatment paths thus identified were further analyzed and refined using stochastic simulation techniques. (Author's abstract) W87-00524

RIVER QUALITY MANAGEMENT UNDER STOCHASTIC STREAMFLOW, Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management. For primary bibliographic entry see Field 5G. W87-0058

PREDICTION OF SULFIDE BUILD-UP IN FILLED SANITARY SEWERS, Monash Univ., Clayton (Australia). Dept. of Chemical Engineering.

JOEEDU, Vol. 112, No. 2, p 199-210, April 1986. 3 fig, 4 tab, 16 ref.

Descriptors: *Sewers, *Sulfates, Sulfides, Slime layer, Sewage, Thistlethwayte, Pomeroy, Removal

The effect of sulfate concentration on the rate of production of sulfide was studied, using a synthetic sewage flowing through a model sewer. While the sulfate ions are being continuously transported along the sewer, their concentration in the sewage is being progressively depleted as they enter the stime (where the conversion to sulfide occurs). Wherever the slime layer is sufficiently thick that the sulfate ions are completely removed before they penetrate to the full depth of the slime, then the depth of penetration will be proportional to the square root of the sulfate concentration at the alime-sewage interface. The rate of removal for thick slimes is proportional to the square root of the sulfate concentration at the surface of the slime. If the composition of the sewage is completely uniform at any cross section, the concentration at the surface of the slime would be the same as those in the bulk phase. However, in sewage systems allowance for mass transfer resistance in the liquid phase (as well as in the slime phase) should be considered. The incorporation of the velocity of flow in the Thistlethwayte equation serves as a mass-transfer factor. The analysis provides a rational explanation as to why in some situations. Promerous a redictive equation may be situations. vides a rational explanation as to why in some situations Pomeroy's predictive equation may be adequate, while in other situations Thistlethwaite's accquate, while in other students in successful and suffice. The experiments indicate that the removal rate was zero-order with respect to sulfate and the value of the rate constant was in the range of 5 to 8 mg per cu cm per hour at 20 C. (Peters-PTT) W87-00589

ENVIRONMENTALLY BALANCED SUGAR REFINERY COMPLEX,

N. L. Nemerow, and A. Dasgupta.

Journal of Environmental Engineering (ASCE)

JOEEDU, Vol. 112, No. 2, p 229-235, April 1986. 2 fig. 8 ref.

Descriptors: *Water pollution control, *Effluents, *Pollutants, *Anaerobic digestion, Zero pollution, Sugarcane

Zero pollution is widely understood as the dis-charge of an effluent that contains no contaminants change of an entuent that contains no contaminants in concentrations sufficient to result in contravention of receiving water criteria. Potential zero poliution can be obtained in a sugar refinery by designing an environmentally balanced industrial complex. The complex would contain a sugarcane refiner, agricultural area for growing sugarcane, alcohol production plant, and a power plant producing both steam and electricity. The heart of this complex is an anaerobic digester, which would handle the refinery's residual wastes. The complex would produce four major products: electrical energy, refined sugar, alcohol, and molasses. In addition, four products would be utilized within the complex: fermentation mash, digested and filtered sludge, digester gas, and steam. No wastes would be released to the air or water environment. (Peters-PTT) centrations sufficient to result in contraven (Peters-PTT)

WASTEWATER TREATMENT AND RENOVA-TION BY DIFFERENT DUCKWEED SPECIES, Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.

G. Oron, D. Porath, and L. R. Wildschut. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 247-263, April 1986. 5 fig, 6 tab, 36 ref.

Descriptors: *Duckweed, *Wastewater treatment, *Economic aspects, Biomass yield, Evaporation, Water loss, Water reuse, Agricultural irrigation.

Duckweed systems for secondary wastewater treatment can be highly productive with a biomass yield of 3 to 15 g per sq m per day (dry weight and a crude protein content in the range of 30 to 40% of dry weight. The obtainable (dry) duckweed yield from one cu m of treated wastewater is at least 15 kg/yr (at duckweed yield of about 10 g/ sq m/day and wastewater depth of 0.20 m). Assuming a value of \$0.25/kg of dry duckweed matter, the return equals at least \$0.04/cu m of treated wastewater. The cost of wastewater treatment, which normally is in the range of \$0.10 to \$0.25/cu m, can be reduced by the proposed system by around \$0.03/cu m. When higher duckweed yields are obtained, this economic aspect will be even more attractive. The duckweed's amino weed yields are obtained, this economic aspect will be even more attractive. The duckweed's amino acid composition and the ease of its harvesting converts the vascular floating plants into a high potential for wastewater treatment and, simulta-neously, into an alternative protein source. Around 20% of water loss due to evaporation can be saved in duckweed ponds, as compared with other wet processes. The ease of duckweed harvesting makes the potential treatment system even more attrac-tive. The treated wastewater is at an acceptable level and can be reused for agricultural irrigation. (Peters, PTT) (Peters-PTT)

TERTIARY TREATMENT WITH FERRATE AND OZONE

University of Petroleum and Minerals, Dhahran (Saudi Arabia). Dept. of Civil Engineering. S. Farooq, and A. Bari.

Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 301-310, April 1986. 9 fig, 1 tab, 16 ref. Saudi Arabian National Center for Science and Technology Grant SANCST AR-

Descriptors: *Ozonation, *Effluents, *Water quality standards, *Secondary wastewater treatment, *Coliforms, *Ferrate, Ozone, Turbidity, Chemical oxygen demand, Coagulation, Flocculation, Sedimentation, Filtration, Suspended solids.

mentation, Filtration, Suspended solids.

A bench-scale pilot plant study was conducted to determine the improvements in effluent quality of secondary treated wastewater using ferrate (VI) and ozone with the primary objective of achieving coliform level of 2.2 MPN/100 ml for reuse purposes. The batch study showed that a ferrate dose of 15 mg/l gave effective removal of turbidity, COD, and coliform. In a continuous flow study a mixture of ferrate stock solution and secondary effluent at a flow rate of 250 ml/min, was subjected to ferrate (15 mg/l) coagulation and flocculation for 45 min followed by sedimentation, filtration, and ozonation. Ozone gas was allowed to react for 5 min in a contactor for an ozone utilization of 1 - 5.8 mg/l of the effluent with resulting ozone residual (peroxide) of 0.4 - 1.9 mg/l. This treatment has shown a significant improvement with respect to removal of suspended solids (70.8%), turbidity (78%), besides achieving the desired level of disinfection (total coliform of 99.99941/9 and total plate count 99.99%). Turbidity increased temporarily to 510% after addition of 99.99941% and total plate count 99.99%). Turbidity increased temporarily to 510% after addition of ferrate due to the presence of a fine suspension but it was reduced to 3 NTU after filtration. Ozonation had very little effect on turbidity and suspended solids as most of these were removed during filtration. A slight increase in pH value occurred after ferrate treatment but no significant change was observed during ozonation. (Peters-PTT) W87-00595

OLFACTORY QUANTIFICATION OF SEWAGE

National Univ. of Singapore. Dept. of Civil Engi-

Waste Treatment Processes—Group 5D

L. C. C. Koe, and D. K. Brady. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 311-327, April 1986. 8 fig. 2 tab, 17 ref, 2 append.

Descriptors: *Wastewater, *Odors, *Sulfides, Quantification, Olfactometer, Densitometer, Sewage air odor concentrations, Masking.

Procedures for measuring sewage odor are examined and a standard odor unit is recommended for odor quantification of a mixture of odorous gases. Field experiments involving simultaneous measurements of odor and hydrogen sulfide levels at two wastewater sites handling significantly different types of wastes were carried out. Odor level was measured with a dynamic olfactometer, while hydrogen sulfide concentration was determined with a paper tape densitometer. Results reveal that the odor concentration of sewage can be correlated with the hydrogen sulfide concentration. The odor levels exerted by sewage air were also compared against that exerted by a commercially prepared levels exerted by sewage air were also compared against that exerted by a commercially prepared hydrogen sulfide gas standard. These results reveal a natural masking effect of hydrogen sulfide odor in sewage air. Sensitivity to odor is so variable among individuals that, in a random sample as small as 21 persons, the most acute sense of smell was about 100 times more sensitive than the dullest. It is suggested that odor concentrations be expressed in terms of standard odor units per cubic meter. Interference effects among odorous subexpressed in terms of standard odor units per cubic meter. Interference effects among odorous substances in sewage air render it invalid to assume that its overall odor concentration may be calculated by summing the independent contributions of its odorous constitutents. The masking phenomenon renders the human sense of smell much more difficult to quantify than the sense of sight and hearing, and it follows that human observers are unlikely to be superseded by machines for quantification of odors. (Peters-PTT)

NITRIFICATION IN WATER HYACINTH TREATMENT SYSTEMS, State Univ. of New York at Buffalo. Dept. of Civil

Engineering.
A. S. Weber, and G. Tchobanoglous.
Journal of Environmental Engineering (ACSE)
JOEEDU, Vol. 111, No. 5, p 699-713, October
1985. 8 fig, 5 tab, 20 ref, append.

Descriptors: *Secondary wastewater treatment, Nitrification, *Water hyacinth, *Wastewater treat-ment, Aquatic plants, Dissolved oxygen, Ammo-

Factors affecting the nitrification rate in post-secondary water hyacinth treatment systems are investigated. Parameters studied include ammonia concentration, dissolved oxygen concentration, and system mixing. The nitrification rate was found to be influenced by al. of the foregoing parameters, and was most sensitive to dissolved oxygen concentration. Based on the results of this study, nitrification in water hyacinth treatment systems is rate-limited by dissolved oxygen concentration. (Author's abstract) W87-00645

EFFECT OF ACCLIMATISATION ON THE TOXICITY OF CHEMICALS TO ACTIVATED SLUDGE MICROORGANISMS,

Water Research Centre, Stevenage (England). E. F. King, and H. A. Painter. Environmental Pollution (Series A) EPEBD7, Vol. 39, No. 3, p 267-280, November 1985. 7 tab, 11 ref.

Descriptors: *Toxicity, *Bacteria, *Acclimatiza-tion, *Activated sludge, *Wastewater treatment, Sludge, Microorganisms, Chemical sludge.

Legislation controlling the use of new chemicals and concern for environmental protection have resulted in a surge of interest in tests for toxicity to bacteria. Currently used tests for inhibition of respiration, nitrification and growth of sewage bacteria are normally short-term and use unacclimatized microorganisms. This failsafe' design is open to criticism, in that safety margins are normally high,

taking no account of acclimatization which may lower toxicity for continuously discharged chemicals. To investigate the possibility of acclimatization, activated sludges have been exposed to six organic chemicals for 3 months. Their toxicity (EC50) was assessed before and after exposure. Results identified only one acclimatized sludge (for pentachlorophenate), although more tolerant bacterial species could also be isolated from the sludges exposed to cetyl trimethyl ammonium brocedure used generally was not successful in promoting selection of resistant species. (Author's abstract) W87-00661

SEWAGE EFFLUENTS AS DRINKING WATER FOR NIGERIAN POULTRY, Ibadan Univ. (Nigeria). For primary bibliographic entry see Field 3C. W87-0068

EFFECTS OF DIFFERENT TEMPERATURE REGIMES ON MICROBIAL ACTIVITY AND BIOMASS IN COMPOSTING MUNICIPAL SEWAGE SLUDGE,

ati Univ., OH. Dept. of Biological Sci-

V. L. McKinley, and J. R. Vestal. Canadian Journal of Microbiology CJMIAZ, Vol. 31, No. 10, p 919-925, October 1985. 3 fig, 3 tab, 25 ref. EPA Grant CR-80 7852-01-0.

Descriptors: *Sludge, *Sludge composting, *Wastewater treatment, *Biomass, Temperature, Municipal wastes, Wastewater, Compost.

Municipal wastes, Wastewater, Compost.

Municipal sewage sludge was composted under two different temperature regimes. The temperatures within the composting piles were regulated using a temperature feedback system controlling aeration fans which blew air up through the piles. Each composting run lasted about 2.5 weeks. In one part of the composting pile, the mean temperatures were kept below about 58 C, while in the other part the mean temperatures reached 84 C. Two experimental composting runs of this type were performed. In both cases the major treatment effect was the highly significant difference in microbial activity (14-C acetate incorporation into lipids) per gram of compost or per unit of microbial biomass, with the low-temperature part of the piles having the greatest activity. Microbial biomass (measured as lipid phosphate) was greater in the low-temperature part of the pile by day 10 of the second composting run. The pH of the low-temperature piles also tended to increase faster than that of the high temperature piles. These results confirm other work in which increased rates of CO2 production were detected in materials composted at lower temperatures. The efficiency of hatch composting process is greater at moderate. composted at lower temperatures. The efficiency of batch composting process is greater at moderate temperatures (not exceeding about 55 C, since higher temperatures greatly inhibited the growth and metabolism of the microbiota. (Author's abstract) W87-00708

STUDIES OF SELECTIVE ABSORPTION RESINS. XXII. REMOVAL AND RECOVERY OF ARSENIC ION IN GEOTHERMAL POWER WASTE SOLUTION WITH CHELATING RESIN CONTAINING MERCAPTO GROUPS, oto Univ. (Japan). Dept. of Industrial Chemistry.

Chemistry.
H. Egawa, T. Nonaka, and H. Maeda.
Separation Science and Technology SSTEDS,
Vol. 20, No. 9/10, p 653-664, November-December 1985. 6 fig. 3 tab, 6 ref.

Descriptors: *Wastewater treatment, *Geothermal power, *Water recovery, *Chelating agents, *Ar-senic, Resins, Ions, Mercapto groups, Chemical analysis, Water analysis, Reagents, Hydrogen ion

Removal and recovery of harmful arsenic ion in a geothermal power waste solution with three macroreticular chelating resins containing mercapto groups were investigated. The resin (RES), which

was prepared from 2,3-epithiopropyl methacrylate-divinylbenzene copolymer beads, exhibited high affinity for arsenic (III) ions and high resistance against hot water. In the column method, arsenic (III) ions in an aqueous solution, were favorably adsorbed on the RES when the sodium arsenies olution (pH 6.2) containing 3 mg/cu dm arsenic (III) ion was passed through the RES column at a space velocity of 15/h. The arsenic (III) ion adsorbed was eluted by allowing 2 mol/cu dm sodium hydroxide solution containing 3% of sodium hydroxen sulfide to pass through the column. The recycle of absorption and elution was astisfactory. The RES also exhibited high absortion ability for arsenic ion in the geothermal power waste solution. (Author's abstract) W87-00728

MULTI-STAGE AIR FLOTATION OF TAR SAND WASTEWATER,

University of Wyoming Research Corp., Laramie. Western Research Inst.

B. T. Nolan, W. F. McTernan, and C. J. Lava. Journal of Energy Engineering (ASCE) JEEED9, Vol. 112, No. 1, p 14-24, April 1986. 6 fig, 6 tab, 12

Descriptors: *Wastewater treatment, *Chemical wastewater, *Tar sand, *Utah, Oil recovery, Wastewater, Bitumen, Steam-driven recovery, Air flotation, Process water, Contamination, Organic compounds, Emulsifiers.

In 1980, the Department of Energy's Laramie Energy Technology Center conducted a steam-driven tar sand recovery experiment near Vernal, UT. This experiment yielded 1,150 barrels of bitumen and 6,250 barrels of process water, which was highly contaminated with emulsified oils and dissolved organica. The process waters were successfully treated by bench-scale, continuous-flow air flotation (AF), but significant amounts of very dilute sludge were generated. The present study investigated the effect of adding a second flotation stage to the AF system, to thicken stage I sludge, produce a clean effluent suitable for recycling, and thereby increase the hydraulic efficiency of the system. (Author's abstract) W87-00755

MIT TIPLE BINDING OF HEAVY METALS BY DIGESTED SLUDGE,

Birmingham Univ. (England). Dept. of Civil Engi-

C. F. Forster, I. Mehrotra, and K. R. K. Alibhai. Journal of Chemical Technology and Biotechnology JCTBED, Vol. 35B, No. 2, p 145-154, June 1985. 9 fig, 5 tab, 16 ref.

Descriptors: *Heavy metals, *Digested sludge, *Adsorption, Zinc, Lead, Chromium, EDTA, Kinetics, Zinc acetate, Lead acetate, Chromic chloride, Thermodynamics, Anaerobic digestion,

The multiple interactions of heavy metals with anaerobically digested sludges and with digested aludge washed with EDTA have been examined by equilibrating the sludge solids with solutions containing mixtures of zinc acetate, lead acetate, and chromic chloride at 20 C. Langmuir and Freundlich isotherms were used to describe the metal binding behavior of the solids, and the rates of adsorption were measured. This showed that while the rate constants were independent of the added metal concentration for untreated sludge, the binding constant for washed sludge was related to the initial metal concentration. Results suggest the following hypothesis. (1) There is essentially only one type of site on the digested sludge surface. (2) EDTA destroys a number of the sites, modifies the remainder, and exposes or produces additional but limited numbers of new sites, altering removal rates and rate constants; and (3) The adsorption of zinc is site-specific, while that of lead and chromium is not, so that the adsorption of zinc to washed sludge is discriminated against both on thermodynamic and kinetic grounds. (Doria-PTT) W87-00760 W87-00760

Group 5D—Waste Treatment Processes

PARAMETERS FOR THE OPERATION OF BACTERIAL THIOSALT OXIDATION PONDS, Canada Centre for Mineral and Energy Technology, Ottawa (Ontario). M. Silver.

Applied and Environmental Microbiology AEMIDF, Vol. 50, No. 3, p 663-669, September 1985. 5 fig, 1 tab, 11 ref.

Descriptors: *Biological treatment, *Thiobacillus, *Oxidation ponds, *Biological wastewater treat-ment, Mine wastes, Design criteria, Lead, Thiosalt, Wastewater treatment.

Shake flask and pH-controlled reactor tests were used to determine the mathematical parameters for a mixed-culture bacterial thiosalt treatment pond. Values determined were as follows: K sub m and V sub max (thiosulfate), 9.83 g/liter and 24.9 mg/liter; per h, respectively; K sub i (lead), 3.17 mg/liter; K sub i (copper), 1.27 mg/liter; Q sub 10 between 10 and 30 C, 1.95. From these parameters, the required biooxidation pond volume and residence time could be calculated. Soluble zinc (0.2 g/liter) and particulate mill products and by-prod-gritery and particulate mill products and by-proddence time could be calculated. Soluble zinc (0.2 g/liter) and particulate mill products and by-products (0.25 g/liter) were not inhibitory. Correlation with an operating thiosalt biooxidation pond showed the parameters used to be valid for thiosalt concentrations up to at least 2 g/liter, lead concentrations of at least 10 mg/liter, and temperatures of 2 C. Measured thiosalt oxidation rates from a pilot plant biooxidation pond corresponded to only 70% of the values predicted from the parameters defined herein. These inconsistencies correlate either with great variations in the thiosalt concentrations of the mill effluents, which disturb the steady-state growth characteristics of the bacteria, or with congestion of the biooxidation pond with particulates. The particulate matter impedes the flow and introduces dissolved copper and other heavy metals which inhibit bacterial thiosalt oxidation in the pond. (Doria-PTT)

COPPER (2+) ZINC (2+) AND NICKEL (2+) EFFECTS ON ACTIVATED SLUDGE, Universidad Complutense de Madrid (Spain). Dept. de Quimica Industrial. A. Vian, F. Mirada, and J. J. Rodriguez. Journal of Environmental Science & Health (A) JESEDU, Vol. 20, No. 7, p 823-835, October 1985. 6 fig. 1 tab, 25 ref.

Descriptors: *Copper, *Zinc, *Nickel, *Activated sludge, *Heavy metals, Wastewater treatment, Chemical oxygen demand, Oxygen demand.

Chemical oxygen demand, Oxygen demand.

The presence of Cu (2+) in activated sludge leads to a rapid and significant decrease of substrate removal efficiency which stabilizes at a new dependent level of the influent Cu(2+) concentration. COD removal lowers from an initial 95% to 82-84% for 1 mg/l influent Cu(2+). This decreases to 58-59% at 5.3 mg/l Cu(2+), and to 46-49% at 10 mg/l Cu(2+). The effect of Zn (2+) is similar, but slower and quantitatively lower: from a stationary COD removal of 91-93%, efficiency drops to 64% for 5.2 mg/l influent Zn(2+), to 56% for 10 mg/l Zn(2+) is lower still; at 10 mg/l Ni(2+). The effect of Ni (2+) is lower still; at 10 mg/l Ni(2+). A nearly additive effect is observed for Zn(2+)/Ni(2+) mixtures at influent concentrations of 10 mg/l each. The combined effect of the three metals together is significantly lower than the sum of their individual effects; for an additive effect, a COD removal efficiency reduction of nearly 75% would be expected at 5 mg/l each, whereas a 44% reduction is obtained experimentally. (Doris-PTT)

SAFETY UNDER THE STREETS, BAFELI UNDER ARE STREETS, Brown and Caldwell, Portland, OR. C. S. Zickefoose, and S. Berg. American City & County, Vol. 101, No. 2, p 48-50, 52, 54, 56, 58, February 1986.

Descriptors: *Safety, *Wastewater treatment, *Sewers, *Education, Wastewater collection, Li-

ability, Accidents, Hazards, Legal aspects, Judicial decisions, Legislation.

Deaths, injuries, and personal liability claims often result when supervisors in charge of wastewater collection and treatment systems fail to heed safety concerns. Responsibility for implementing safe working conditions lies with the supervisor directly in charge of the facility. Employers can minimize the risk of potential claims by: (1) being familiar with state and federal standards; (2) examinating the state of t familiar with state and federal standards; (2) examining workplace conditions to assure compliance; (3) removing or guarding against hazards; (4) providing safe tools and protective gear; (5) displaying warning signs; and (6) establishing and enforcing safe operating procedures. According to many mucipal officials, the most hazardous condition to be addressed is the training and protection of workers for entry into confined areas. Case histories are discussed of the problems and experiences of wastewater treatment plants in setting up safety programs. (Doria-PTT)
W87-00765

POTENTIAL HAZARDS TO OPERATIVES IN THE WATER INDUSTRY,
Severn-Trent Water Authority (England).
D. R. Woods.

D. R. WOODS.
Institution of Civil Engineers Proceedings PCIEAT, Vol. 80, Part 1, p 53-67, February 1986.
1 fig, 2 tab, 16 ref.

Descriptors: *Hazards, *Wastewater treatment, *Safety, Sewers, Wastewater facilities, Wells, Tunnels, Boreholes.

Work in confined spaces such as sewers, pipelines, and tunnels imposes stresses that can increase the risk of accident even during routine procedures. Hazardous atmospheres present danger of fire, explosion, asphyxiation, and poisoning. Chemicals used in water and sewage treatment works may present risks of explosion, burning, or toxicity. The regestest potential hazards arise through use of present risks of explosion, burning, or toxicity. The greatest potential hazards arise through use of chlorine as a disinfectant. Sewers are hazardous work places by nature, and present the danger of hazardous physical conditions, flooding and drowning, and the generation of dangerous atmospheres. Wells, boreholes, and tunnels pose similar dangers, such as when boreholes penetrate methanshazarine strate. In the case of process along the dangers, such as when boreholes penetrate methane-bearing strata. In the case of process plants, the sludge digestion process presents the greatest potential for the accumulation of hazardous atmospheres in confined spaces such as tanks, pumping station wet wells, and sludge heating houses. Some aspects of design features important in minimizing hazards are discussed, especially those associated with the sludge digestion process and with the handling and storage of chemicals. The importance of a multidisciplinary approach at the design stage is emphasized. (Doria-PTT)

FIVE N.E. COMMUNITIES JOIN IN SEWER PROJECT,

B. Quinn.
American City & County, Vol. 100, No. 9, p 70, 72, 74, September 1985.

Descriptors: *Sewer systems, *Wastewater man-agement, *New Hampshire, *Massachusetts, Plan-ning, Management planning, Long-term planning, Multi-objective planning.

Salem, New Hampshire has entered into a long-range plan with Massachusetts for the diversion of Salem's wastewater to the under-utilized Greater Lawrence Sanitary District (GLSD) in Massachusetts. The project was undertaken in response to the lack of federal funds for wastewater treatment. the lack of federal funds for wastewater treatment, and encouraged by the adoption of tax-restricting measures in Massachusetts. Despite the expected advantages, the state of New Hampshire applied a sewer tie-in ban on Salem in May, 1984. Consulting engineers developed a plan for the construction of new connecting sewers that would serve as force mains during the interim period. Following implementation, the same sewers would accept a reversed flow, serving as gravity sewers in the longrange plan. Salem has meanwhile eliminated its sewer tie-in ban, giving them a two-year head start

on their long-range plan for effective wastewater management. (Doria-PTT) W87-00767

CHEMICAL CHANGES OF ORGANIC COM-POUNDS IN CHLORINATED WATER: X. FOR-MATION OF POLYCHLORINATED METHYL-MATION OF POLYCHIODRINATED METHYLPHENOXYMETHYLPHENOLS (PREDIOXINS)
DURING CHLORINATION OF METHYLPHENOLS IN DILUTE AQUEOUS SOLUTION,
Tokyo Univ. (Japan). Faculty of Pharmaceutical For primary bibliographic entry see Field 5B. W87-00793

5E. Ultimate Disposal Of Wastes

TERTIARY TREATMENT OF SECONDARY EFFLUENT BY DISSOLVED AIR FLOTATION AND FILTRATION (SANDFLOAT) SYSTEM, Krofta Engineering Corp., Lenox, MA. For primary bibliographic entry see Field 5D.

EFFECTIVENESS OF CAPPING IN ISOLAT-ING CONTAMINATED DREDGED MATERIAL FROM BIOTA AND THE OVERLYING WATER,

WATER,
Army Engineer Waterways Experiment Station,
Vicksburg, MS. Environmental Lab.
J. M. Brannon, R. E. Hoeppel, T. C. Sturgis, I.
Smith, and D. Gunnison.
Available from the National Technical Information
Service, Springfield, VA. 22161, as AD-A165251,
Price codes: A04 in paper copy, A01 in microfiche.
Final Report. Technical Report No. D-85-10, November 1985. 50 p, 5 fig, 18 tab, 35 ref, 1 append.

Descriptors: *Capping, *Spoil banks, *Water pol-lution, *Soil properties, Microorganisms, Spores, Overlying water, Absorption, Accumulation, Sand, Clay, Silt, Polychetes, Chemical analysis, Clams, Laboratory tests, Ecological effects, Tissue

analysis.

The effectiveness of capping in chemically and biologically isolating contaminated dredged material was investigated using large- (250 I) and small- (22.6 I) scale laboratory reactor units. The ability of various cap materials to isolate contaminated dredged material was assessed in the large reactor units by following the movement of chemical contaminants and microbial spores contained in the capped dredged material into the overlying water column and by monitoring the biological uptake of chemical contaminants by clams and polychaetes. The depth of cap material needed to chemically isolate contaminated dredged material was assessed in the small-scale reactor units. Three capping materials, sand, clay (New Haven Harbor sediment), and silt (Vicksburg silt), were evaluated for their efficiency in preventing transfer of contaminants from a contaminated sediment into the overlying water column and biota. In the presence of bioturbating polychaetes (Nereis virens) at densities of 100 large animals per square meter, a 50-cm cap of any of the three materials tested in the large chamber experiments was effective in preventing transfer of chemical constitutes and microbial cap of any of the three materials tested in the large chamber experiments was effective in preventing the transfer of chemical constitutes and microbial spores to the overlying water and nonburrowing biota. Chemical analysis of polychaete tissue and visual observation showed that the polychaetes penetrated both the 5-cm and 50-cm cape of all materials tested. Cap materials with higher proportions of clay and silt appear to be more effective than cap materials consisting mainly of sand, especially in preventing contaminant movement into the overlying water and biota. However, a thick cap (50-cm or more) of any of the materials tested effectively isolated the overlying water and non-burrowing biota from the contaminants. (Lantz-PTT) PTT W87-00082

DISCHARGE OF TREATED SEWAGE TO GROUNDWA'TER USING THE HYDRAULIC CRITERIA FOR SLOW SAND FILTRATION, Instituut voor Milieuhygi

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Ultimate Disposal Of Wastes—Group 5E

niek TNO, Delft (Netherlands).

INC, Defit (Vetterstands).

J. A. Somers.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 23-35, 6 fig, 3

Descriptors: *Groundwater pollution, *Wastewater disposal, *Land disposal, *Sand fil-ters, Hydraulic loading, Filtration, Path of pollut-ants, Coliforms, Dissolved oxygen, Denitrification.

The infiltration of the effluents of the pilot plants on the TNO testing grounds was studied. The experiments were carried out indoors in filter columns and outdoors in a 5 sq m experimental filter. The filtration rates varied between 0.06 and 24 cm/h, corresponding to a hydraulic load of 0.1 to 48 population equivalents per sq m. For the (total) counts on nutrients agar, over a filter length of 10 - 20 cm, an 81% reduction was found, increasing to 99% over a length of 410 - 470 cm. For the coliforms, over 10 - 20 cm of filter length a 92% reduction was found, increasing to 99.9% over a length of 410 - 470 cm. About 40 - 60% of the dissolved oxygen in the supernatant was consumed dissolved oxygen in the supernatant was consumed within the first 10 cm of filter sand. Denitrification was responsible for a decrease of the nitrates by about 15%. A provision for the regeneration of the filter surface worked satisfactorily. (See also W87-00127) (Author's abstract)

SAFE WASTE DISPOSAL BY LANDFILL - AN

Department of the Environment, London (England).

R. G. D. Osmond

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 137-145.

Descriptors: *Waste disposal, *Landfills, *Public opinion, Public policy, Legislation, Environmental impact statement, Public participation.

The acceptability of landfill is reviewed with respect to the water sector of the environment. Waste disposal is changing in terminology, public interest and technique and a wide balancing of interests is essential. Legislation, the Gregson Report and the role of the British Department of Report and the role of the British Department of Environment are outlined and reference is made to government-sponsored research and conclusions. The impact of European Community Legislation is reviewed. There is, however, a range of circumstances and attitudes among countries. The importance of public relations and education is stressed, supported by sound operations. Attention is drawn to possible problems (such as leaching into aquifers and groundwater) and how they are being tackled. It is concluded that sensible landfill of domestic and a range of hezardous wastes is accentable. It is concluded that sensions leading of domestic and a range of hazardous wastes is acceptable. Continued collaboration particularly between waste disposal and water authorities can ensure proper protection of water. (See also W87-00127) (Lantz-PTT) W87-00138

CONSTRUCTION OF CAPE PERON OCEAN OUTLET PERTH, WESTERN AUSTRALIA, Metropolitan Water Authority, Perth (Australia). Director of Engineering. For primary bibliographic entry see Field 5C. W87-00194

MARKET POTENTIAL FOR SLUDGE COM-POST PRODUCT, Wisconsin Univ.-Milwaukee. Dept. of Civil Engi-

J.Y.C. Huang.

Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 3, p 454-467, June 1986. 2 tab, 17 ref, 4 append.

Descriptors: *Sludge, *Compost, *Market value, Sod farms, Landscaping, Forestry, Nursery, Greenhouses, Public participation, Wisconsin.

The demand potential of the compost product from municipal wastewater treatment sludges in the Greater Milwaukee (Wisconsin) area was studied. The study illustrates the use of a method to explore the potential demand for the compost product among four possible major users: sod farmer, landscaper/forester, nursery/greenhouse, and general public. The recommended first target market could be individual large users, such as Milwaukee City and County, and certain landscape contractors. The next segment could be sod farmers, nurseries, and greenhouses. The last segment to which marketing is desirable is probably the general population. The market survey showed that the potential demand for the product in southeastern Wisconsin is very good. (Rochester-PTT) W87-00221

FLOW CHARACTERISTICS OF LANDFILL LEACHATE COLLECTION SYSTEMS AND LINERS, Stevens Inst. of Tech., Hoboken, NJ. Dept. of

For primary bibliographic entry see Field 5B. W87-00223

LEACHATE COLLECTION SYTEMS. CH2M Hill, Newport Beach, CA. M. Ghassemi.

JOEEdU, Vol. 112, No. 3, p 613-617, June 1986. 2 tab, 5 ref. EPA Hazardous Waste Engineering Research Laboratory Contract No. 68-03-1828.

Descriptors: *Leachate collection systems, *Water pollution control, *Landfills, *Environmental Protection Agency, Laboratories, Hazardous wastes, Management planning.

Key findings and conclusions of the recent report to EPA's Hazardous Waste Engineering Research Laboratory entitled 'Leachate Collection and Gas Migration and Emission Problems at Landfills and Surface Impoundments' are presented and discussed. There is little hard data on the long-term performance of leachate collection systems (LCS) in full-scale facilities. Correlation of performance with design should be possible in older facilities. The actual or potential problems of LCS can best be addressed through preventive measures such as incorporation of redundancies in design, adequate QA/QC during construction and operating controls designed to minimize leachate generation and improve leachate control capability. (Alexander-PTT) PTT) W87-00226

COINCIDENT PLASMIDS AND ANTIMICRO-BIAL RESISTANCE IN MARINE BACTERIA ISOLATED FROM POLLUTED AND UNPOL-LUTED ATLANTIC OCEAN SAMPLES, Maryland Univ., College Park. Dept. of Microbi-

For primary bibliographic entry see Field 5C. W87-00259

MUTAGENIC ACTIVITY OF SOILS AMEND-ED WITH TWO REFINERY WASTES, Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences. For primary bibliographic entry see Field 5C. W87-00344

TRACE ELEMENT LEACHING IN BENCH-SCALE RECIRCULATING ASH TRANSPORT

SYSTEMS,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
For primary bibliographic entry see Field 5B.
W87-00445

HAZARDOUS WASTE SURFACE IMPOUND-MENT TECHNOLOGY,

Multidisciplinary Energy and Environmental Sys-tems and Applications, San Pedro, CA. M. Ghassemi, and M. Haro.

Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 5, p 602-617, October 1985, 4 tab, 3 ref. EPA Contract 68-02-3174, Sub-contracts M98967JQ3E, M98968JQ3E.

Descriptors: *Hazardous materials, *Waste disposal, *Waste dumps, *Land disposal, *Waste management, Design criteria, Landfills, Solid waste disposal, Environmental effects, Project planning, Clays, Linings, Reservoirs, Case studies.

The design, construction and performance data for hazardous waste surface impoundments at nine facilities were reviewed, and actual and projected cilities were reviewed, and actual and projected performances were compared. Discussions were also held with four design engineering firms, one waste management company, one liner installer/fabricator, and regulatory agencies in three states. The following were identified as being essential in achieving good site performance: siting in suitable geological formation; continuity of the geotechnical support throughout the project planning, site investigation, design, and construction; construction supervision to ensure adherence to specifications; compaction of clay wet of optimum to eliminate air space; consideration of compatibility with waste in selecting liner material; rigorous QA/QC to ensure adequate design and proper liner; and providing and maintaining protective cover for liners. (Author's abstract) W87-00517

WATER DIVERSION AT LOW LEVEL WASTE DISPOSAL SITES

Oak Ridge National Lab., TN. Environmental Sciences Div.

For primary bibliographic entry see Field 5G. W87-00520

FACTORS AFFECTING THE MINERALIZA-TION OF NITROGEN IN SEWAGE SLUDGE APPLIED TO SOILS,

Agricultural Research Service, Beltsville, MD. Soil-Microbial System Lab.

A. Barbarika, L. J. Sikora, and D. Colacicco. Soil Science Society of America Journal SSSID4, Vol. 49, No. 6, p 1403-1406, November-December 1985. 2 fig. 5 tab, 17 ref.

Descriptors: *Soil amendments, Nitrogen, *Sludge disposal, *Mineralization, Temperature effects, Statistical analysis, Moisture, Soil factors.

An empirically-based model predicting N mineralization rate in sewage sludge amended soils was developed by analyzing several sets of published laboratory data. Analysis of the data indicates that both soil and sewage-sludge factors affect the organic N mineralization rate. Factors positively affecting mineralization rates were total N content of the soil, and the duration and temperature of the incubation. Negatively affecting mineralization were the C/N ratios of the sludge and soil. Two of the estimated equations resulting from the statistical analyses were tested on the results of a sixth incubation study in which several different sludges were incubated under the same time, temperature, moisture and amendment rate conditions and a 0.75 correlation coefficient was obtained. The resulting model equation using data from all 6 studies indicated that soil factors are important variables in predicting mineralization of N in sewage sludge amended soils. (Peters-PTT)

MUNICIPAL SEWAGE SLUDGE APPLICA-TION ON OHIO FARMS: HEALTH EFFECTS,

TION ON OHIO FARMS: HEALTH EFFECTS, Ohio State Univ., Columbus. Dept. of Veterinary Preventive Medicine.
C. R. Dorn, C. S. Reddy, D. N. Lamphere, J. V. Gaeuman, and R. Lanese.
Environmental Research ENVRAL, Vol. 38, No. 2, p 332-359, December 1985. 6 fig. 17 tab, 48 ref. Ohio Farm Bureau Federation - US EPA Cooperative Agreement CS805189.

Group 5E-Ultimate Disposal Of Wastes

Descriptors: *Land disposal, *Sludge disposal, *Ohio, *Human diseases, Farms, Pastures, Diseases, Infection, Health effects, Pollutants, Epidemiology, Public health.

miology, Public health.

A 3-year prospective epidemiologic study was conducted on 47 farms receiving annual applications of treated sludge (average of 2-10 dry metric tons/ha/year) and 46 control farms in three geographic areas of Ohio. On the sludge-recieving farms 164 persons (78 families) and on the control farms 130 persons (53 families) and on the control farms 130 persons (53 families) participated by cooperating with monthly questionnaires concerning their health and their animals' health, annual tuberculin testing, and quarterly blood sampling for serological testing. The estimated risks of respiratory illness, digestive illness, or general symptoms were not significantly different between sludge farm and control farm residents. There were no observed differences between disease occurrence in domestic animals on sludge and on control farms. No conversions from negative to positive tine tests results occurred after sludge had been applied to the farms. The frequency of aerological conversions (fourfold or greater rise in antibody) to a series of 23 test viruses and the frequency of associated illnesse were similar among persons on sludge and control farms. The sheence of observed human or animal health effrequency of associated illnesses were similar among persons on sludge and control farms. The absence of observed human or animal health effects resulting from sludge application in this study of Ohio farms was associated with low sludge application rates which were in accordance with Ohio and U.S. Environmental Protection Agency Guidelines. Caution should be exercised in using these data to predict health risks associated with sludges containing higher levels of disease agents and with higher sludge application rates and larger acreages treated per farm than used in this study. (See also W87-00650 thru W87-00651) (Author's abstract) abstract) W87-00649

MUNICIPAL SEWAGE SLUDGE APPLICA-TION ON OHIO FARMS: TISSUE METAL RESIDUES AND INFECTIONS, Ohio State Univ., Columbus. Dept. of Veterinary Preventive Medicine.

C. S. Reddy, C. R. Dorn, D. N. Lamphere, and J. D. Powers.

L. FOWERS.
Environmental Research ENVRAL, Vol. 38, No. 2, p 360-376, December 1985. 1 fig. 9 tab, 38 ref.
Ohio Farm Bureau Federation - US EPA Cooperative Agreement CS805189.

Descriptors: *Land disposal, *Sludge disposal, *Ohio, Farms, Municipal wastewater, Metals, Tissue analysis, Infection, Animal diseases, Cadmium, Copper, Lead, Zinc, Grazing bacteria, Calves, Kidneys, Cattle.

Transmission of infectious agents and translocation of Cd, Cu, Pb, and Zn from anaerobically digested studge to the tissue of farm animals grazing on pastures to which studge was applied (2-10 metric tons per hectare) were studied on eight farms. No alguificant health risk associated with the possible presence in studge of Salmonella spp., or of common animal parasites including Nematodirus app., Stongulaide per Trichusieros. common animal parasites including Nematodirus spp., Strongylus spp., Strongyloides spp., Trichuris spp., Eimeria spp., Ascaris spp., and Ancyclostomum spp. was noted. Caudal fold as well as cervical tuberculin testing indicated no conversions from negative to positive following exposure of cattle to sludge. Significantly higher feed Cd concentrations were detected in samples collected from cattle soon after being placed on sludge treat-ed pastures compared to preexposure values in the same animals. Significant Cd and Pb accumulations were found in the kidneys of calves grazing sludge treated pastures compared to control calves. Alterest of pastures compared to control calves. were found in the kidneys of calves grazing aludge treated pastures compared to control calves. Al-though older cows grazing aludge treated pastures had significantly higher blood Pb levels, no metal accumulation was noticed in the other tissues. Sta-tistically significant accumulations of Cd and Pb in the kidney of calves grazing these pastures for a relatively short period suggests that caution should be exercised to avoid prolonged grazing of cattle on pastures receiving heavy sludge applications, especially with sludges containing high concentra-tions of heavy metals. (See also W87-00649 thru W87-00651) (Author's abstract)

MUNICIPAL SEWAGE SLUDGE APPLICA-TION ON OHIO FARMS: ESTIMATION OF CADMIUM INTAKE, Ohio State Univ., Columbus. Dept. of Veterinary Preventive Medicine. C. S. Reddy, and C. R. Dorn. Environmental Research ENVRAL, Vol. 38, No. 2, p 377-388, December 1985. 5 tab, 25 ref. Ohio Farm Bureau Federation - US EPA Cooperative Agreement CS805189.

Descriptors: *Cadmium, *Siudge disposal, *Municipal, *Land disposal, *Ohio, Wastewater, Grazing, Cattle, Farms, Feces, Pastures.

Cattle, Farms, Peces, Pastures.

This study was designed to estimate the contribution of municipal sewage sludge exposure and smoking to the daily Cd intake in Ohio farm residents, based on the Cd concentrations in 24-hr fecal samples. Samples were analyzed for Cd and the daily Cd intakes were calculated by correcting for absorption (4.6%) in the gastrointestinal tract. Fecal samples from cattle grazing on sludge-treated pastures were also similarly treated except that published 24-hr fecal weights and a 2% absorbtion corrected were used. Fecal weights and the daily Cd intakes, in humans, calculated from these data were lower in females than in males with a female/male ratio of 0.77/1. Daily Cd intakes calculated from these data ranged from 5.37 to 13.31 microgram/day for females and 8.87 to 18.52 microgram/day for females and 8.87 to 18.52 microgram/day for smokers was 1 microgram/day higher than for nonsmokers, the difference was not statistically significant. Cattle grazing on sludge-treated pastures consumed significantly more (up to 3 times) Cd than cattle on control pastures. It was concluded that application of sewage sludge on farmlands at rates of 2-10 dry metric tons/ha did not significantly contribute to the daily Cd intake in humans; cattle on such farms, however, significantly increased their Cd consumption. (See Also W87-0064), W87-00650) (Author's abstract) W87-00651

SOME CHARACTERISTICS OF THE BEHAV-IOUR OF INDICATOR BACTERIA IN SEWAGE-AMENDED SOIL, Oklahoma Univ. Health Sciences Center, Oklaho-

ma City. Dept. of Environmental Health.
D. D. Ibiebele, A. D. Inyang, C. H. Lawrence, R.

L. Coleman, and N. Pees.
Environmental Pollution (Series A) EPEBD7,
Vol. 39, No. 2, p 175-182, October 1985. 2 fig, 1 tab. 26 ref.

Descriptors: *Sludge disposal, *Soils, *Sludge-amended soils, Bacteria, Streptococcus, Undigest-ed aludge, Feces, Pollution, Infection, Diseases, Coliforms, Soil amendments.

The abundance, sensitivity to environmental conditions and growth recovery characteristics of fecal coliform bacteria and Streptococcus faccalis (indicator bacteria) were monitored in experimental plots receiving various quantities of undigested sewage sludge. The results of the study show that there were fewer streptococci in the sludge, but more in the soil, than the fecal coliforms. Survival time of both groups of bacteria was not significantly different. The streptococcal numbers were not directly related to the quantity of sludge (pollutant) applied to the soil. Growth recovery was exhibited only by the Streptococcus faecalis. (Author's abstract) dance, sensitivity to environmental condi-W87.00650

HYDRAULIC TRAP FOR PREVENTING COL-LECTOR WELL CONTAMINATION: A CASE

Alberta Univ., Edmonton. Dept. of Geology. For primary bibliographic entry see Field 5G. W87-00686

SEWAGE EFFLUENTS AS DRINKING WATER FOR NIGERIAN POULTRY, Ibadan Univ. (Nigeria).
For primary bibliographic entry see Field 3C.

W87-00689

DREDGED-MATERIAL DISPOSAL SYSTEM CAPACITY EXPANSION, Hydrologic Engineering Center, Davis, CA. For primary bibliographic entry see Field 5G. W87-00754

5F. Water Treatment and **Quality Alteration**

PERMITTING THE MERCUR GOLD MINE TAILINGS POND, Getty Mining Co., Salt Lake City, UT. For primary bibliographic entry see Field 5G. W87-00053

RAPID, SAFE DRINKING WATER SUPPLY PRODUCTION METHOD.

PRODUCTION METHOD, Los Alamos Technical Associates, Inc., NM. H. F. Gram, M. E. Muller, and A. M. Pendergrass. Available from the National Technical Information Service, Springfield, VA. 22161, as ADA 125219, Price codes: A05 in paper copy, A01 in microfiche. Final Technical Report DAAK-70-82-C-0045, Oc-tober 24, 1982. 92 p, 6 fig, 11 tab, 14 ref, 2 append.

Descriptors: *Drinking water, *Water treatment, *Ozonation, Sodium chloride, Electrolysis, Water quality control.

Ozone and chlorine-hypochlorite were generated electrolytically in weak NaCl solutions using currents of 5-25 volts and 2-8 amps, and ambient temperatures using platinum plated electrodyse. The prototype unit electrolyzed 1 l/min of water on a continuous basis. One volume of electrolyzed solution sterilized and deodorized 40 volumes of newage contaminated surface stream water in sewage contaminated surface stream water in about 10 minutes at a production rate of 600 gal/ hr. The unit is compact (20 cu inches) and porta-ble, and can replace chlorination as a more rapid and thorough disinfection process. (Author's abstract) W87-00074

COMPARISON OF MEMBRANE MULTIPLE-FERMENTATION-TUBE, AND PRESENCE-ABSENCE TECHNIQUES FOR DETECTING TOTAL COLIFORMS IN SMALL COMMUNITY WATER SYSTEMS, Dartmouth Medical School, Hanover, NH. Dept. of Microbiology.
For primary bibliographic entry see Field 5A. W87-00170

RECOVERY AND DIVERSITY OF HETERO-TROPHIC BACTERIA FROM CHI.ORINATED DRINKING WATERS,

WASHING WALENS, Washington Univ., Seattle. Dept. of Microbiology and Immunology. For primary bibliographic entry see Field 5A. W87-00171

ASSESSING THE RELIABILITY OF SUPPLY AND LEVEL OF SERVICE FOR WATER DISTRIBUTION SYSTEMS,

Imperial Coll. of Science and Technology, London (England).

(England). G. German anopoulos, P. W. Jowitt, and J. P. Lumbers.

Proceedings of the Institution of Civil Engineers, Part 1, Vol. 80, p 413-428, April 1986. 1 tab, 5 fig, 14 ref, append.

Descriptors: Water distribution, *Networks, *Main sewers, Network failing, Burst mains, Simulation models, Crisis events.

A method for assessing the security of supply from a water distribution system associated with differ-ent network failure events such as burst mains or source failures uses a network simulation model to study the operation of the network both under normal operating conditions and conditions arising

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration—Group 5F

from crisis events. The effect of different failure from crass events. In effect of different failure events on the supplies to the area considered is identified, and a probability analysis of the occurrence of such events is then used to provide an assessment of the security of water supply. Operational responses that should be triggered by crisis events are also identified by the network simulaevents are also identified by the network simulations. For the case study area presented, it is found that the assessment of supply reliability obtained using the above methodology is considerably different from that suggested by the conventional approach, which simply relates supply reliability to the amount of emergency storage available in the network. The development of robust dynamic models giving a better account of a water distribution system's operation under failure conditions could be important both operationally and in assessing the reliability of wather supplies to various points in the system, and is a challenging field for further work (Alexander-PTT)

DETERMINATION OF HALOGENATED PHENOLS IN RAW AND POTABLE WATER BY SELECTED ION GAS CHROMATOGRA-PHY-MASS SPECTROMETRY, Environmental Health Directorate, Ottawa (Ontar-

For primary bibliographic entry see Field 5A. W87-00213

COMMUNITY WATER SUPPLY AND SANITA-TION IN DEVELOPING COUNTRIES, 1970-1990. AN EVALUATION OF THE LEVELS AND

TRENDS OF SERVICES, Pan American Health Organization, Guatemala

City. F.L.O. Deck. World Health Statistics Quarterly, Vol. 39, No. 1, p 2-31, 1986. 10 tab, 5 ref.

Descriptors: *Community development, *Infant mortality, *Water supply, Sanitation, *Southeast Asia, *Rural areas, Human population, Correlation analysis, Developing countries, Regional develop-

The health effects of water supply and sanitation conditions were evaluated in terms of the correlation between these services and infant mortality as a health level indicator. The present review is based chiefly on data collected in World Health Organization surveys 1970, 1980, and 1983. From 1970 to 1983, when water sweet the correspondent a health level midicator. In e present review is based chiefly on data collected in World Health Organization surveys 1970, 1980, and 1983. From 1970 to 1983, urban water supply coverage rose from 65% to 74%, reflecting a 100% increase in population served. In rural areas, access to safe water increased from 12% to 40% from 1970 to 1983, a 300% service expansion in the face of 20% population growth. From 1970 to 1983 urban sanitation coverage appeared to decrease from 73% to 53%, largely because of developments the South-East Asia Region, which reported lower numbers of people served in 1983 than in 1970. Rural sanitation levels increased modestly from about 7% to 11% during the 1970-83 period. Provisional rank correlation results suggest that, under certain circumstances, significant correlations may exist between sector coverages of water supply and sanitation and infant mortality, that are independent of factors, such as level of gross national product, which are known to affect both variables. (Rochester, PTT) ter-PTT) W87-00242

WATER SUPPLY AND SANITATION IN THE SOUTHEAST-ASIA REGION, World Health Organization, New Delhi (India). Regional Office for South-East Asia. N. Saravanapavananthan. World Health Statistics Quarterly, Vol. 39, No. 1, p 58-70, 1986. 2 fig, 5 tab, 1 ref.

Descriptors: *Community development, *Regional development, *Southeast Asia, *Water supply development, *Sanitation, Human population, Bangladesh, Burma, India, Indonesia, Maldives, Nepal, Sri Lanka, Thailand, Statistical analysis.

The progress of community water supply and sewage disposal services development in the

ber states of the World Health Organization, h-East Asia Region, since the beginning of the member states of the World Health Organization, South-East Asia Region, since the beginning of the International Drinking Water Supply and Sanitation Decade is reviewed. Countries participating in the Decade progress monitoring activities were: Bangladesh, Burma, India, Indonesia, Maldives, Nepal, Sri Lanka, and Thailand. Two sets of agregated analyses were carried out: one without India and one including India. In urban areas, water supply coverage did not keep sace with India and one including India. In urban areas, water supply coverage did not keep pace with increasing populations, whereas in rural areas it appears that mid-decade targets will be achieved overall, but on a country by country basis, only Bangladesh, India, Indonesia, and Sri Lanka are likely to meet or exceed their mid-decade targets. In the area of sanitation, coverage increased in urban areas in the 1981-83 period, but in rural areas improvements in sanitation coverage did not keep pace with population. Major constraints identified by the countries in the 1983 sector update were as follows: lack of adequate financial resources, lack of community participation, logistics, insufficient health education, and import restrictions. (Rochester-PTT) ter-PTT) W87-00245

APPLICATION OF APPROPRIATE TECH-NOLOGY IN THE FIELD OF RURAL WATER SUPPLY IN INDONESIA, World Health Organization, Djakarta (Indonesia). Regional Office for South-East Asia. S.F. Mathur.

World Health Statistics Quarterly, Vol. 39, No. 1, 71-80, 1986. 2 fig, 3 tab, 9 ref.

Descriptors: *Groundwater potential, *Indonesia, *Community development, *Water supply, *Apropriate technology, Drilling, Regional development, Statistics, Hand pumps, Artesian wells, Tube wells. Thailan

Development of rural water supply in Indonesia is discussed under the following headings: background, well-drilling program (agencies responsible, groundwater utilization, and targets and achievements), and new approaches to overcome initial difficulties (hydroselocical unvecet information until drilling evidence of the control of the proaches to overcome initial difficulties (hydrogeological support information, well-drilling equipment and well design, choice of hand pumps, and manpower development). Data are presented showing occurrence of groundwater in Indonesia, appropriate technological options for supplying water local populations by provinces in Indonesia (shallow-well hand pumps, deep-well hand pumps, and artesian wells), construction of water-supply facilities during the period 1969-84 and proposed for 1984-89, construction of hand-pump facilities and digging of artesian wells during 1969-84 and proposed for 1984-89, and activities of the tube-well drilling program in Thailand. (Rochester-PTT) PTT) W87-00246

INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE PROGRAMME IN THE PHILIPPINES, Ministry of Health, Manila (Philippines).

Ministry of Health, Manua (Philippines).
P.R. Imperio.
World Health Statistics Quarterly, Vol. 39, No. 1, p 93-104, 1986. 1 fig, 3 tab, 1 ref, 1 append.

Descriptors: *Philippines, *Water supply, *Sanita-tion, *Regional development, *Management plan-ning, Hygiene, Drinking water, International drinking water supply and sanitation decade, Com-munity development, Education, Training.

The Philippine experience with the International Drinking Water Supply and Sanitation Decade program is reviewed under the following headings: situation before the Decade program, decade activities, organization and management, planning and programming, implementation, internal and external investments (1981-84), operation and maintenance, coordination, community participation. ternal investments (1981-84), operation and mainte-nance, coordination, community participation, training, and monitoring and evaluation. Data are presented on morbidity and mortality rate (1980-84) in the Philippines from diseases related to unsafe water and poor hygiene, households with safe drinking water and appropriate sanitation, and coverage and levels of water supply and sanitation

service (January 1984). The author concludes that the Decade program is on its way to fulfilling its objectives. Many factors are judged to be responsible for the success of the program, including community participation through the primary health care approach, intensified health education, strong government support (funding), internstional and bilateral support as well as World Health Organization technical assistance, close coordination and cooperation among implementing agencies, training of managerial and technical staff and community-level workers, the use of appropriate technology, and effective supervision. (Rochester-PTT) W87-00248

HEALTH EFFECTS AND IMPACT OF WATER SUPPLY AND SANITATION,
Andrija Stampar School of Public Health, Zagreb

Andrija Suampa (Yugoslavia). B. Cujetanovic. World Health Statistics Quarterly, Vol. 39, No. 1, p 105-117, 1986. 4 fig, 5 tab, 32 ref.

Descriptors: *Sanitation, *Public health, *Infant mortality, *Water supply, Regional development, Developing countries, Water-related diseases, Sanitation-related diseases, Socioeconomic factors,

Selected information on the health benefits of water supply and sanitation are reviewed and the concepts, methodologies, and interpretation of studies on health effects are analyzed. Topics include effects on disease incidence and nutritional status, effects on health status, and health benefits and economic aspects. The impact of water supply and sanitation on health depends on the quality and quantity of water supply and sanitation, the proportion of the population covered, and the utilization of the water and sanitation facilities by the population. The direct effects of water supply and sanitation on water-related and sanitation-related diseases are only one of the components of health sanitation on water-related and sanitation-related diseases are only one of the components of health benefits measured by a decrease in incidence of these diseases. Another, frequently more important, effect is the indirect impact of water supply and sanitation through socioeconomic, educational, and other improvements on the health status of the population, (Rochester-PTT)
W87-00249

RELATIONSHIP OF DRINKING WATER DIS-INFECTANTS TO PLASMA CHOLESTEROL AND THYROID HORMONE LEVELS IN EX-

PERIMENTAL STUDIES,
Oak Ridge Research Inst., TN.
N. W. Revis, P. McCauley, R. Bull, and G.

Proceedings of the National Academy of Sciences, USA, PNASA6, Vol. 83, No. 5, p 1485-1489, March 1986. 2 fig, 2 tab, 25 ref. Oak Ridge Re-search Institute Contract NO. 810053-01.

Descriptors: *Drinking water, *Disinfectants, *Chlorine dioxide, *Monochloramine, *Thyroxine, High-cholesterol diet, Blood plasma, Pigeons, Or-ganic matter, Gastrointestinal tract.

ganic matter, Gastrointestinal tract.

The effects of drinking water containing 2 or 15 ppm chlorine (JH 6.5 and 8.5), chlorine dioxide, and monochloramine on thyroid function and plasma cholesterol in male, white carneau pigeons (age, 3-4 mo) were studied. Plasma thyroxine (T4) levels, as compared to controls, were significantly decreased in pigeons fed a normal or high-cholesterol diet and drinking water containing these drinking water disinfectants at a concentration of 15 ppm (except chlorine at pH 6.5) for 3 months. In most treatment groups, T4 levels were significantly lower following the exposure to drinking water containing the 2 ppm dose. Increases in plasma cholesterol were observed frequently in the groups with lower T4 levels. This association was most evident in pigeons fed the high-cholesterol diet and exposed to these disinfectants at a dose of 15 ppm. For example, after 3 ppm monochloramine, plasma cholesterol was 1,266 + or - 172 and 2,049, + or - 212 mg/dl, respectively. The authors suggest that the effects of these disinfectants on T4 and cholesterol probably are mediated by products

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formed when the disinfectants react with organic matter in the upper gastrointestinal tract. (Rochester-PTT)

STUDIES ON MICROBIAL QUALITY OF FIL-TERED WATER IN HOUSEHOLDS OF A UNI-VERSITY COMMUNITY IN NIGERIA,

Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Veterinary Surgery. D. A. Alabi, and A.A. Adesiyun. Journal of Hygiene, Cambridge, Vol. 96, No. 2, p 239-248, April 1986. 6 tab, 13 ref.

Descriptors: *Water treatment, *Filters, *Microorganisms, *Nigeria, *Coliforms, Plate counts, Reservoirs, Ahmadu Bello University, Filter candles, Hygiene, Escherichia coli, Enterobacter.

Microbial quality of water from home filters in nine residential areas of Ahmadu Bello University, Nigeria, was determined using the membrane filter technique to obtain counts of total and fecal coliforms per 100 ml of water. Most ot the 100 samples studied were grossly contaminated with total coliforms counts ranging from 0-442/100 ml, fecal coliform counts of 0-216/100 ml, and a total aerobic plate count of 3000 to 1.9 x 10(9) colony-forming units/ml. The source (dams) of water, fitness of filter candles, frequency of cleaning candles, and pH of water did not significantly affect the microbial quality of either filtered boiled or unboiled tap water. Escherichias coli type I was isolated from 17.9% of the fecal coliforms tested but from only 2.3% of the total coliforms. Enterobacter aerogenes was most predominant (38.5%) bacter aerogenes was most predominant (38.5%) among fecal coliforms isolated, whereas Enterobacter cloacae was the most frequent (37.2%) of the total coliform isolates. (Rochester-PTT)

INJURED COLIFORMS IN DRINKING

Montana State Univ., Bozeman. Dept. of Microbi-

G. A. McFeters, J. S. Kippin, and M. W. LeChevallier.

Applied and Envrionmental Microbiology AEMIDF, Vol. 51, No. 1, p 1-5, January 1986. 2

Descriptors: *Coliforms, *Drinking water, Water treatment, Chlorination, Filtration, New England,

Coliforms were enumerated by using m-Endo and LES and m-T7 agar in 102 samples of drinking water from three New England water systems to investigate the occurrence and significance of injured coliforms. Samples included water collected after conventional treatment, during the backwash cycle, at various points in the distribution system, and 1 week after the break and subsequent repair of a distribution main. Injured coliforms in these samples averaged greater than 95%. m-T7 agar yielded 8- to 38-fold more coliforms than did m-Endo agar LES. The geometric mean of coliforms yielded 8- to 58-fold more coliforms than did m-Endo agar LES. The geometric mean of coliforms recovered by m-Endo agar LES was less than I confirmed coliform per 100 ml, although M-T7 agar yielded 5.7 to 67.5 confirmed coliforms per 100 ml. The majority of samples giving positive results on M-T7 agar produced no detectable counts on m-Endo agar LES. These findings indi-cate that coliforms were injured and largely unde-tected by accepted analytical media in the systems examined. (Main-PTT)

INACTIVATION OF CAMPYLOBACTER
JEJUNI BY CHLORINE AND MONOCHLOR-

AMINE, Colorado Univ. Health Sciences Center, Denver. Div. of Infectious Diseases.

M. J. Blaser, P. F. Smith, W. L. Wang, and J. C.

Applied and Environmental Microbiology AEMIDF, Vol. 51, No. 2, p 307-311, February 1986. 2 fig. 3 tab, 19 ref. EPA Cooperative agree-ment R81-0169.

Descriptors: *Chlorination, *Disinfection, *Chlorine, *Human diseases, *Microorganisms, *Drinking water, Bacteria, Monochloramine, Diseases, Infection, Inactivation, Pollution, Water treatment.

fection, Inactivation, Pollution, Water treatment. Campylobacter jejuni and closely related organisms are important bacterial causes of acute diarrheal illness in the United States. Both endemic and epidemic infections have been associated with consuming untreated or improperly treated surface water. We compared susceptibility of three C. jejuni strains and Escherichia coli ATCC 11229 with standard procedures used to disinfect water. Inactivation of bacterial preparations with 0.1 mg of chlorine and 1.0 mg of monochloramine per liter was determined at pH 6 and 8 and at 4 and 25 C. Under virtually every condition tested, each of the three C. jejuni strains was more susceptible than the E. coli control strain, with greater than 99% inactivation after 15 min of contact with 1.0 mg of monochloramine per liter or 5 min of contact with 0.1 mg of free chlorine per liter. Results of experiments in which an antibiotic-containing medium was used suggest that a high proportion of the remaining cells were injured. An animal-passaged C. jejuni strain was as susceptible to chlorine disinfection procedures commonly used for treatment of drinking water. This suggests that disinfection procedures commonly used for treatment of drinking water to remove coliform bacteria are adequate to eliminate C. jejuni and are correlated with properly ang water to remove comorn bacteria are adequate to eliminate C.jejuni and are correlated with the absence of outbreaks associated with properly treated water. (Author's abstract) W87-00358

METHODS FOR ISOLATING CAMPYLO-BACTER JEJUNI FROM LOW-TURBIDITY

ninistration Medical Center, Denver, CO. Infectious Diseases Section.
For primary bibliographic entry see Field 5A.
W87-00359

BELGIAN EXPERIENCES IN THE OZONIZA-

TION OF WATER, Compagnie Intercome (Belgium). nunale Bruxelloise des Eaux

(Beignum).
W. J. Masschelein.
Ozone Science and Engineering OZSEDS, Vol. 7,
No. 4, p 327-350, Fall 1985. 13 fig, 6 tab, 29 ref.

Descriptors: *Water treatment, *Ozonation, Costs, Economic aspects, Belgium, Tailfer plant, Drink-

After reviewing the uses of ozone in the preparation of drinking water, high purity water for phamaceuticals industries, and swimming pools
throughout Belgium, a discussion of technological
developments made at the Tailfer plant (serving
Brussels) concerning the uses of ozone is presented. Progress at this plant involved the analytics
and monitoring of the process, ozone to water
contacting methods and processes, treatment of
off-gases, and the use of an oxygen-enriched process gas. After three years of full-scale operation,
this principle is confirmed as feasible and economical eyes on a non-recycling basis of the off-cas. It this principle is confirmed as reasible and economical even on a non-recycling basis of the off-gas. It is recommended that new water treatment plants specify designs and materials that will permit the use of oxygen or oxygen-enriched air, with eventual recycling of the process gas. (Peters-PTT) W87-00388

IMPACT OF FILTRATION ON WATER QUAL-ITY IN WADING POOLS.

Manitoba Univ., Winnipeg.
I. L. Johnson, L. Sekla, D. G. Luckhurst, S. Sew, and J. Manfreda.
Canadian Journal of Public Health CJPEA4, Vol. 76, No. 5, p 317-321, September/October 1985. 1 fig, 4 tab, 19 ref.

Descriptors: *Water quality, *Water treatment, *Filtration, Winnipeg, Manitoba, Wading pools, Swimming pools, Recreation facilities, Bacteria,

During the summer of 1983, 4 wading pools were studied in the City of Winnipeg to assess the value

of filtration in maintaining the recreational water quality when the 'fill and draw' method was used daily. The filtration had no additional effect in reducing either turbidity or the frequency of isolation of several bacterial indicators. Bacteria were isolated from 50% of the evening samples. The most frequently isolated bacterium was Staphylococcus aureus (43%) followed by fecal streptococcus (17%). Higher bather attendance and lower chlorine concentration were associated with the isolation of bacteria from the pool water. The results raise questions about the requirements of filtration when the 'fill and draw' method is used and show the importance of monitoring S. aureus as a bacterial indicator of water quality for wading pools. (Author's abstract) pools. (Author's abstract) W87-00393

APPLICATION OF DISSOLVED AIR FLOTA-TION TO THE LENOX, MASSACHUSETTS WATER SUPPLY: WATER PURIFICATION BY

WATER SUFFLY THE ACT OF THE ACT O

Descriptors: *Water treatment, *Flotation, *Pota-ble water, *Flocculation, *Feasibility studies, Dis-solved air flotation, Massachusetts, Lenox.

On July 19, 1982 a 1200000 G/d water tres On July 19, 1982 a 1200000 G/d water treatment facility opened in Lenox, Massachusetts. The heart of the Lenox Water Treatment Plant is an award-winning dissolved air flotation package. The Lenox water resources system, water quality, treatment plant design and construction are described. The start-up and operational data are summarized. The Lenox plant is the first full scale potable flotation plant ever built in America and has been proven to be a feasible system for water purification. (Jessick-PTT) W87-00401

APPLICATION OF DISSOLVED AIR FLOTA-TION TO THE LENOX, MASSACHUSETTS WATER SUPPLY: SLUDGE THICKENING BY FLOTATION OR LAGOON,

Lenox Inst. for Research, Inc., MA.
M. Krofta, and L. K. Wang.
New England Water Works Association Journal,
Vol. 99, No. 3, p 265-284, September 1985. 3 fig. 6

Descriptors: *Water treatment, *Sludge thickening, *Flocculation, *Flotation, *Flitration, *Wastewater treatment, *Sludge lagoons, *Alum sludge, Dissolved air flotation, Massachusetts, Lenox.

An innovative potable flotation plant (1.2 MGD capacity) services the town of Lenox, Massachusetts. Its processing system consists of chemical floculation, dissolved air flotation, and automatic backwash sand filtration. The detention time of the Lenox facility is only 15 minutes in comparison with the conventional systems 6-9 hours. A unique feature of the Lenox plant is that it recycles and reuses its filter backwash wastewater. This system improves upon the conventional floculation, sedimentation and filtration system in performance, capability, operation, maintenance, energy use, and overall cost. This paper introduces the sludge handling and disposal methods being used in the nations first potable flotation plant. (Jessick-PTT) W87-00402

LONG CONTACT TIME OZONATION FOR SWIMMING POOL WATER TREATMENT,

Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie. D. Eichelsdorfer, and J. Jandier. Ozone Science and Engineering OZSEDS, Vol. 7, No. 2, p 93-106, Spring 1985. 9 fig. 1 tab, 13 ref.

Descriptors: *Swimming pools, *Ozonation, *Water treatment, Recreational facilities, Sieves Flocculation, Filtration, Chlorination, Disinfec-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration—Group 5F

tion, Ozone combi block process, Hydraulic systems, Chlorinated hydrocarbons, Chloroform.

tems, Chlorinated hydrocarbons, Chloroform.

The elimination of contaminants in pool water through the 'ozone activated carbon process' is accomplished in four steps: (1) sieving, (2) flocculation, (3) filtration and (4) ozonation. According to the German standards for the Treatment of Swimming Pool Water, the toxic ozone has to be removed from the water by filtration through an activated carbon layer before the water is brought back into the swimming pool. Disinfection is then accomplished by chlorination. In the ozone process described and in most of its modifications the time available for the reaction of the ozone is very short, usually 1.5 to 3 minutes. First, results with ozonation of model compounds, such as urea, creatinine, amino acids, etc., have shown that the reaction time leads to an improved decontamination of the swimming pool water. The efficiency of the ozonation process with longer reaction times followed by slower filtration has been proven in a research project, e.g. by experiments with the so-called 'Ozone Combi Block - Process'. The potassium permanganate consumption and the combined chlorine as well as the formation potential of haloforms can be reduced effectively by elongated contact time of ozone. (Author's abstract)

W87-00406 W87-00406

IMPACT OF PREOZONATION ON THE GRANULOMETRIC DISTRIBUTION OF MA-TERIALS IN SUSPENSION,

Montpellier-2 Univ. (France). Lab. d'Hydrologie

S. Mathonnet, C. Casellas, G. Bablon, and J. Bontoux.

Ozone Science and Engineering OZSEDS, Vol. 7, No. 2, p 107-120, Spring 1985. 4 fig, 4 tab, 11 ref.

Descriptors: *Ozonation, *Suspended solids, *Distribution graphs, Surface water, Organic carbon, Laser granulometry, Seine River, Water analysis, Granulometry, Seasonal variation.

The impact of preozonation on the granulometric distribution of materials in suspension was studied. The quality of the Seine River water undergoes significant fluctuations as a function of seasonal periods. The raw and ozonized waters were analyzed by a laser granulometer. The analysis of the granulometric distribution established that the suspended materials constitute four Gaussian populations and makes evident the modifications caused by ozone on this granulometry, as well as, on the particulate organic carbon. Laser granulometry has proven to be interesting in water analysis. It supplied more complete information than that furnished by other methods currently being utilized. (Jessick-PTT) W87-00407 W87-00407

TREATMENT OF HUMIC WATERS BY OZONE

Norges Tekniske Hoegskole, Trondheim. Selskapet for Industriell og Teknisk Forskning. H. Flogstad, and H. Odegaard. Ozone Science and Engineering OZSEDS, Vol. 7, No. 2, p 121-136, Spring 1985. 11 fig, 1 tab, 7 ref.

Descriptors: *Water treatment, *Ozone, *Drinking water, Norway, Humic water, Ozonation, Electrical equipment, Irradiation, Color removal, Molecular weight reduction, Mathematical models.

Two different ozone generators were tested, a traditional electrical discharge generator and a generator based upon UV-irradiation of air at 150-180 nm. The traditional generator gave slightly higher reductions in levels of color for equivalent ozone dosages. A mathematical model was developed which expressed color levels as a function of the ratio between dosage and raw water color. Both gases affected the molecular weight distribution in the way that the bigger molecules were broken down to smaller ones. No significant difference between the molecular weight reduction efficiency of the gases was found. (Author's abstract) W87-00468 W87-00408

REGULATORY DEVELOPMENT OF THE IN-TERIM AND REVISED REGULATIONS FOR RADIOACTIVITY IN DRINKING WATER -PAST AND PRESENT ISSUES AND PROB-LEMS,

Environmental Protection Agency, Washington, DC. Office of Drinking Water. For primary bibliographic entry see Field 5B. W87-00411

RADIOLOGICAL SAMPLING AND ANALYTI-CAL METHODS FOR NATIONAL PRIMARY DRINKING WATER REGULATIONS, Eastern Environmental Radiation Facility, Mont-gomery, AL. For primary bibliographic entry see Field 5A. W87-00412

COMPLIANCE AND POLICY ISSUES AND RECOMMENDATIONS RELATED TO REVI-SION OF THE NATIONAL INTERIM PRI-MARY DRINKING WATER REGULATIONS FOR RADIONUCLIDES,

Alabama Rural Water Association, Montgomery. J. E. Regnier, R. Blanchard, M. W. Carter, E. Cowan, and J. Martin. Health Physics, Vol. 48, No. 5, p 695-699, May 1985, append.

Descriptors: *Regulations, *Drinking water, *Radioactivity, Radionuclides, Maximum contaminant level, Water quality standards.

The deliberations and conclusions of the Compliance and Policy Committee of the National Workshop for Radioactivity in Drinking Water are summarized. Thirty-two possible compliance and policy issues were considered during the workshop. Twenty-two were determined to be valid. The committee adopted positions on seven of these issues. The remaining twenty-five are also listed with the committee's evaluation of each. (Author's abstract) abstract)

CALCULATING THE PH OF CALCIUM CARBONATE SATURATION,

ental Science and Engineering, Inc. esville, FL. Gautesville, FL.

R. A. Pisigan Jr., and J. E. Singley.

American Water Works Association Journal

JAWWA5, Vol. 77, No. 10, p 83-91, October 1985,

4 fig. 8 tab, 31 ref.

Descriptors: *Hydrogen ion concentration, *Calcium carbonate, *Saturation, Equilibrium, Corrosion control, Mathematical models, Langlier equation, Larson-buswell formula, Chemical analysis, WAT-SPEC2, Computer programs.

Two new expressions for the pH of saturation (pH sub s) were derived. The first is a simplified equation developed from an aqueous carbonate equilibrium system in which correction for ionic strength was considered. The second is a more accurate quadratic formula that involves computerized calculation of pH sub s and takes into account ionic speciation and an activity correction factor. Differ-ing methods of calculating pH sub s of 155 water speciation and an activity correction factor. Differ-ing methods of calculating pH sub s of 155 water samples were compared using the Langlier equa-tion, the Larson-Buswell formula, the two pH sub s, equations derived in this study, two mathemati-cal models, the WATSPEC2 computer program, and the Caldwell-Lawrence diagrams. (Author's abstract) W87-00438

PARTICLES, PRETREATMENT, AND PER-FORMANCE IN WATER FILTRATION, Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering. C. R. Omelia.

JOEEDU, Vol. 111, No. 6, p 874-890, December 1985. 2 fig, 31 ref. EPA grant R808104.

Descriptors: *Pretreatment of water, *Packed beds, *Suspended solids, Water treatment, Water

Relationships among raw water quality, pretreatment facilities, and the design of packed bed filters are presented and applied. The particle size, particle concentration, particle surface characteristics, and solution chemistry in the water supply have important and predictable effects on filter design. mujorusus and predictable effects on filter design. An integrative approach to water treatment plant design, from raw water quality to filter bed performance, will facilitate process evaluation and has the potential for poviding a basis for plant design. (Author's abstract)

W87-00448

CONTROLLING TRIHALOMETHANE FOR-MATION POTENTIAL BY CHEMICAL TREATMENT AND ADSORPTION,

King Saud Univ., Riyadh (Saudi Arabia). Coll. of

Engineering.
A. A. Jodellah, and W. J. Weber.
American Water Works Association Journal
JAWWA5, Vol. 77, No. 10, p 95-100, October
1985. 11 fig, 3 tab, 10 ref. EPA Grant 80735901.

Descriptors: *Organic carbon, *Chemical treatment, *Adsorption, *Water treatment, *Lime, Separation techniques, Organic compounds, Alum, Coagulation, Humic acids, Activated carbon, Fulvic acid, Chlorination.

Removal of total organic carbon (TOC) from humic solutions by adsorption, alum coagulation, lime softening, or a combination of chemical treatment and adsorption generally resulted in a reduction in the formation of trihalomethanes (THMs). Although high levels of TOC removal by adsorption were found to increase incrementally THM reduction, high levels of TOC removal by alum coagulation or lime softening generally decreased the incremental reduction of THM formation, as reflected by the THM formation potential (THMFP). Because greater removal of TOC does not necessarily produce greater reduction of THMFP, it is suggested that water treatment systems intended to remove THMs should be optimized specifically to control that parameter rather than to maximize TOC removal. (Author's abstract) stract) W87-00503

REDUCING ALUMINUM RESIDUALS IN FIN-ISHED WATER,

Progressive Consulting Engineers, Minneapolis, MN.

N. Quershi, and R. H. Malmberg. American Water Works Association Journal JAWWA5, Vol. 77, No. 10, p 101-108, October 1985. 7 fig. 10 tab, 21 ref.

Descriptors: *Water treatment, *Aluminum, *Chemical treatment, *Ferric chloride, *Coagulation, Turbidity, Separation techniques, Drinking water, Alum, Lime, Filtration, Sulfates, Flocculation, Hydrogen ion concentratio

Pilot and full-scale tests were conducted in Minneapolis in an attempt to reduce aluminum residuals in finished water. At high pH, when the predominant mode of alum coagulation is sweep coagulation, increasing the intensity of chemical mixing reduced aluminum residuals only slightly. Reducing the pH with acid was effective in reducing the residuals, but posttreatment pH adjustment with lime to stabilize the water increased its hardness. The most promising means of reducing aluminum residuals appears to be to replace part of the alum dosage with ferric chloride. At both Minneapolis and St. Paul, water treatment with ferric chloride, at less than half the alum dosage, reduced the residuals and resulted in longer filter runs. With ferric chloride, the sulfate content of the finished water was lowered, a more stable water was pro-Pilot and full-scale tests were conducted in Min water was lowered, a more stable water was produced, and the cost savings were significant. Ferric chloride slightly increased the iron and chloride levels in finished water, but the increase in chloride posed no significant problem. (Geiger-PTT) W87-00504

IDENTIFYING WATER MAIN LEAKS WITH TRIHALOMETHANE TRACERS,

Group 5F-Water Treatment and Quality Alteration

Glenmore Waterworks Lab., Calgary (Alberta). For primary bibliographic entry see Field 8A. W87-00506

TWO-STAGE FILTRATION, Montgomery (James M.), Inc., Pasadena, CA. S. Kawamura. American Water Works Association Journal JAWWA5, Vol. 77, No. 12, p 42-47, December 1985. 5 fig, 6 tab, 3 ref.

Descriptors: "Filtration, "Flocculation, "Water treatment, "Pilot plants, "Coagulation, Separation techniques, Turbidity, Taste, Odor, Color, Sedi-mentation, Gravel, Filters, Packed beds.

The two-stage filtration process which incorporates an initial bank of coarse filters, followed by a bank of final filters that are normally operated at a high filtration rate was examined in pilot studies. Type I two-stage filtration, which includes flocculation and settling was examined at the Amagasaki water treatment plant of the Hanshim Metropolitan Water District, Japan. Type 2 two-stage filtration which uses a coarse gravel bed to flocculate material was studied at Anchorage Alaska during the treatment of Eklutna Lake water. Results showed that if the raw water frequently exhibits high turbidity or presents taste and odor problems, type I two-stage filtration should be used. If the raw water quality is good enough to allow direct filtration, then type 2 two-stage filtration may be used. (Geiger-PTT)

EFFECT OF SLOW SAND FILTER MAINTE-NANCE ON WATER QUALITY, New York State Dept. of Environmental Conser-vation, Schenectady. vation, Schenectady.

T. R. Cullen, and R. D. Letterman.

American Water Works Association Journal
JAWWA5, Vol. 77, No. 12, p 48-55, December
1985, 9 fig, 4 tab, 18 ref. EPA Agreement CR-810-

Descriptors: *Sand filters, *Water treatment, *Filtration, *Maintenance, Water quality, Particulate matter, Turbidity, Filtrate, Drinking water, Chlorination, Cost analysis.

Full-scale municipal slow sand filters at seven sites in the Syracuse, NY, area were monitored before, during, and after filter scraping to verify the presence or absence of a ripening period, to determine the filter run length, and to quantify the labor and material required for scraping and resanding operations. Results showed some evidence of a ripening second service force 6 he to 2 like in force of the labor. ations. Results showed some evidence of a ripening period, ranging from 6 hr to 2 wk, in four of the 10 operations monitored. The presence or absence of a ripening period did not seem to be related to the use of prechlorination, to water temperature, to scraping methodology, or to frequency of filter maintenance. The factor that seemed to have the most significant effect on the quality of the filtrate was the amount and nature of the particulate matter present in the raw water. (Author's abstract) stract) W87-00508

GASTROENTERITIS: CASE STUDY OF A COL-ORADO OUTBREAK, Ohio Univ., Athens. Coll. of Health and Human

For primary bibliographic entry see Field 5C. W87-00509

ISOLATING VIRUSES FROM FINISHED WATER,
Arizona Univ., Tucson. Coll. of Agriculture.
For primary bibliographic entry see Field 5A.
W87-00511

REMOVAL OF ORGANIC MATTER IN WATER TRANSPORT,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
M. R. Collins, G. L. Amy, and P. H. King.
Journal of Environmental Engineering (ASCE)

JOEEDU, Vol. 111, No. 6, p 850-864, December 1985. 8 fig, 4 tab, 20 ref.

Descriptors: *Organic matter, *Water treatment, *Filtration, *Organic compounds, Comparison studies, Organic carbon, Humic acids, Separation techniques, Flocculation, Sedimentation, Water

The performance of several types of water treatment plants in removing various molecular weight (MW) fractions of naturally occurring aquatic organic matter and humic substances is described. An assessment was made of the performance of direct filtration, conventional treatment, and softening in removing trihalomethane (THM) precursors from a diverse array of water sources. In addition, a comparison was made between conventional treatment and direct filtration in removing THM precursors from a common water source, the Colorado River. As a general rule, THM reactivity (microgram THM/milligram C) increased with MW although the <10,000 MW range was found to be the most consistently reactive fraction of aquatic organic matter. All of the various treatments preferentially removed the most reactive fraction of precursors present in each molecular weight range. None of the various treatments proved to be very effective in removing precursor material below a MW of <500. The ability to remove THM precursors appears to be related to both the source of humic substances as well as the type of treatment employed. (Author's abstract)

EXTERNAL MASS-TRANSFER RATE IN FIXED-BED ADSORPTION, Stanford Univ., CA. Dept. of Civil Engineering. P. V. Roberts, P. Cornel, and R. S. Summers. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 6, p 891-905, December 1985. 5 fig, 3 tab, 36 ref.

Descriptors: *Water treatment, *Mass transfer, *Adsorption, *Organic compounds, Separation techniques, Activated carbon, Mathematical models, Model studies, Phenols, Industrial wastes,

External mass-transfer coefficients were measured with organic compounds, para-nitrophenol and 2,4-dichlorophenol, under conditions representative of fixed-bed activated-carbon adsorption for water treatment. The superficial velocity was in the range 1.3-8.0 mm/s and the Reynolds number range was 0.8-5. The observed external transfer coefficients are compared with predicted values from four mass-transfer models; the relationship of Gnielinaki best predicts the velocity dependence. The observed transfer coefficients in all cases exceeded the predictions based on ideal spherical geometry. Depending on the conditions and the choice of predictive model, the particle size correction factors ranged from 1.44-2.04. The data from previously published studies show deviations that are similar in direction, but smaller in magnitude. (Author's abstract) External mass-transfer coefficients were measured

LOOPED WATER DISTRIBUTION SYSTEM OPTIMIZATION FOR SINGLE LOADING,

Indian Inst. of Tech., Bombay. Centre for Envi-ronmental Science and Engineering. A. V. Chiplunkar, S. L. Mehndiratta, and P.

Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 264-279, April 1986. 2 fig, 2 tab, 22 ref.

Descriptors: *Water conveyance, *Water distribu-tion, *Computer programs, *Pricing, *Urban areas, Single loading, Analysis program, Economic as-pects, Algorithms, Gravity flow.

An optimization algorithm employing a nonlinear programming technique (Davidon-Fletcher-Powell method) has been developed for the design of large real-life urban water-distribution systems for a single loading. Using the decomposition principle, the NP-hard problem has been solved by iterative and interactive application of the solutions for

analysis and optimization problems, thereby minimizing the number of decision variables. The analysis program provides residual heads for a given set of diameters input by the optimization program in order to enable analytical calculation of the gradient required in the DFP method. The optimization program results in successive generation of ation program results in successive generation of ew sets of diameters that are analyzed with flow new sets of diameters that are analyzed with flow values of the previous diameter set as initial flowa. The efficacy of the optimization program is illustrated through the case study of a complete large, gravity urban water supply system. The program has also been used for sensitivity analysis to ascertain the effect of variable pricing conditions on the optimal solution. A comparison of the optimal solution to that identified by the method of partial enumeration reveals substantial savings (over 25%) through the application of the optimization algorithm developed in this research. The use of this algorithm facilitates judicious utilization of limited financial resources in meeting the goals of the International Drinking Water Supply and Sanitation Decade. (Peters-PTT)

PIPE NETWORK ANALYSIS BY PARTIAL PIVOTING METHOD, Karlsruhe Univ. (Germany, F.R.). For primary bibliographic entry see Field 8A. W87-00618

DIRECT FILTRATION: AN AUSTRALIAN

Hunter District Water Board, Newcastle (Austra-K. Craig

American Water Works Association Journal JAWWA5, Vol. 77, No. 12, p 56-61, December 1985. 10 fig, 13 ref.

Descriptors: *Water treatment, *Filtration, Austra-lia, New South Wales, Costs, Economic aspects.

Study of the water of Chichester Dam, operated by the Hunter District Water Board in New South Wales, Australia, indicated that the supply could possibly be treated by direct filtration at capital and operating costs well below those for conventional treatment. Extensive pilot-plant testing carried out to determine the feasibility of direct filtration included optimization of the media and the chemical system, evaluation of declining rate versus constant-rate filtration, and use of manufactured 'dirty water'. The treatment process selected as a result of these pilot studies was constant-rate direct filtration, with mechanical in-line chemical mixing and no flocculation. (Author's abstract) W87-00642

REMOVAL OF BY-PRODUCTS OF CHLORINE AND CHLORINE DIOXIDE AT A HEMODIA-LYSIS CENTER,

California Dept. of Health Services, Berkeley.

Candidate Peter vives between Between States American Water Works Association Journal JAWWA5, Vol. 78, No. 6, p 94-98, June 1986. 1 fig. 2 tab, 24 ref.

Descriptors: *Chlorine, *Chlorine dioxide, *Hemodialysis, *Disinfection, *Water treatment, *Filtration, Hematological effects, Activated carbon, Byproducts, Chlorite, Oxidation, Water softening,

A case study of the water treatment train at a A case study of the water treatment train at a hemodialysis clinic was performed to determine the effectiveness of the unit processes, both individually and collectively, in removing chlorine dioxide and chlorine as well as their residual oxidants. Units used in the water treatment process included a granular activated carbon unit, an industrial softener and a reverse osmosis unit. Initial data showed that chlorite ion and free chlorine were effectively removed, but because chlorine dioxide and chlorate ion could not be conclusively identified in the chloric's water sumply or in the final identified in the clinic's water supply or in the final product water of the treatment train, their removal could not be determined. (Michael-PTT) W87-00644

Water Quality Control—Group 5G

ECOLOGY OF PLUMATELLA EMARGINATA (ECTOPROCTA:PHYLACTOLAEMATA) IN THE SURFACE WATERS OF MADHYA PRA-DESH WITH A NOTE ON ITS OCCURRENCE

IN THE PROTECTED WATERWORKS OF BHOPAL (INDIA), Bhopal Univ. (India). Dept. of Limnology. P. Shrivastava, and K. S. Rao. Environmental Pollution (Series A) EPEBD7, Vol. 39, No. 2, p 123-130, October 1985. 5 fig, 1 to 12 feet.

Descriptors: *Aquatic plants, *Madhya Pradesh, *Water treatment facilities, *India, Aquatic life, Filters, Chara, Bhopal, Ecosystems, Ecology, Invertebrates, Eutrophication, Plumatella, Surface water, Draganoleptic properties, Odors.

Plumatella emarginata was collected from the filter of the protected waterworks of Bhopal, and many other areas of the State. for comparative purposes and was found to be associated with various plants, particularly Chara spp. The luxuriant growth may cause obstruction in the water supplies and problems of bad odor as it aids the growth of various algal species on its zoarium and also acts as host for various aquatic invertebrates. (Author's abstract) stract) W87-00655

DEHALOGENATION OF ETHYLENE DIBROMIDE BY NICKEL-SCHIFF BASE COM-POUNDS, University of South Florida, Tampa. Dept. of Chemistry.

ary bibliographic entry see Field 5G.

STUDY OF DRINKING WATER QUALITY IN A COMMUNITY OF AMERICANS LIVING IN NAPLES, ITALY, Environmental and Preventive Medicine Unit No.

7, New York.
F. D. Daniell, V. P. Hutcherson, S. E. Waltz, and

Journal of Environmental Health JEVHAH, Vol.

48, No. 4, p 210-212, January-February 1986. 1 fig, 2 tab, 6 ref.

Descriptors: *Naples, *Italy, *Water quality, *Drinking water, Arsenic, Nitrates, Fluorides, Water conveyance, Coliforms, Potable water, Municipal water, Well water.

nicipal water, Well water.

A survey of 80 households was conducted to determine the relative chemical and bacteriological quality of municipal and well water supplied to the residences of a Department of Defense-sponsored community of Americans living overseas in the greater Naples, Italy metropolitan area. Water samples (40 municipal and 40 well) were collected during on-site visits and tested for members of the coliform group of bacteria as well as a battery of chemical parameters for which water quality standards have been established. A total of 28 well water samples (70%) exceeded one or more of the standards against which they were compared. Of these, 28% of the samples exceeded bacteriological standards and 33% exceeded standards for fluoride, 10% for arsenic, and 8% for nitrates. None of the municipal water samples exceeded any of the quality standards. On the basis of this data it was determined that consumption of well water supplied to these residences constituted a potential health risk, and residents supplied with well water were advised to seek an alternate source of drinking water. (Author's abstract)

ANION ANALYSIS OF HIGH PURITY

WATER, Southern California Edison Co., Paramount. For primary bibliographic entry see Field 5A. W87-00688

WATER SUPPLY SYSTEM MODELS WITH CAPACITY EXPANSION,
International Development Center of Japan, Tokyo.

M. Nakashima, H. G. Wenzel, and E. D. Brill. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 1, p 87-103, January 1986. 2 fig. 6 tab, 7 ref.

Descriptors: *Optimization, *Water supply, *Model studies, Pumping, Potential water supply, Water conveyance, Mathematical models.

Water conveyance, Mathematical models.

The goal of this study was to develop an optimization model for designing an economical regional water supply system that consists of water production and water transmission facilities. A method has been developed to determine a water supply system layout and to size water production and transmission facilities in the system. A two-phase heuristic optimization technique is used to solve the models formulated. A Phase I model selects a system layout, along with capacities in a transmission and source system subject to to constraints on water availabilities at potential sources and on increasing water demands. The Phase II model determines facility components, pumping locations, and capacities and pipeline diameters for the transmission system using Phase I model solutions. Based on application of the proposed method, the following conclusions can be made with respect to the Phase I model: (1) The application resulted in optimal solutions for different unit costs of the imported water. The solutions show the expected trend in the changes of the system configuration; (2) Different starting solutions were used for the opumai solutions for directed unit copie of the imported water. The solutions show the expected trend in the changes of the system configuration; (2) Different starting solutions were used for the Phase I nonlinear program and final solutions were judged to be satisfactory; and (3) the MLST was shown to be efficient in solving the large-scale Phase I model. Conclusions about the Phase II model are: (1) The Phase II solutions show that optimal diameters are included in initial lists of candidate diameters except in a few cases, indicating that the method derived from the Phase II procedure and used for estimating the candidate diameters is reasonable; (2) A tendency was observed in the solutions for individual routes to consist of pipes of only one diameter; (3) The model is capable of identifying optimal pumping locations and capacities among candidate locations; and (4) Average execution times were on the order of 1 se on the CYBER 175 to solve the Phase II on 1 se on the CYBER 175 to solve the Phase II linear program for the example programs. (Author's abstract)

TOXIC SCREENING MODELS FOR WATER SUPPLY,

Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div. For primary bibliographic entry see Field 5B. W87-00745

EXPLICIT PIPE NETWORK CALIBRATION, Kentucky Univ., Lexington. Dept. of Civil Engineering. For primary bibliographic entry see Field 8B. W87-00746

CASE STUDY: PIPE NETWORK MODEL CALI-

BRATION ISSUES, Army Engineer Waterways Experiment Station, Vicksburg, MS. T. M. Walski.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 238-249, April 1986. 1 fig, 3 tab, 11 ref.

Descriptors: *Case studies, *Networks, Pipes, Water transport, Mathematical models, Model studies, Reducing valves, Calibration.

A model of a real water distribution system can be calibrated so that the model predicts pressure to within 5 psi and head loss to within 30% for a range of loadings for the low and high zones. The key to accurate modeling is collecting accurate data for a range of conditions. This includes pressure and elevation data accurate to 2 ft (0.6 m) at both test and boundary nodes, and the results of fire flow tests to simulate high water use situations. If observed and predicted heads are only compared at a single loading, it is possible to mistakenly conclude that a model is calibrated when, in

reality, errors in one parameter are compensating for errors in another parameter. The corrections to initial estimates of C-factor and water use can be calculated, and are useful in providing rough guidance in how to correct input data, but are limited by: (1) The accuracy of data; and (2) the inability to assign corrections to individual nodes and pipes rather than groups of nodes and pipes. The key to using the results of this paper, however, is not so much the equations presented (they merely help the modeler zero in on the correct calibration more quickly than trial and error); rather the key is collecting sufficient good quality data over a range of flows. (Lantz-PTT)

CHEMICAL CHANGES OF ORGANIC COM-POUNDS IN CHLORINATED WATER: X. FOR-MATION OF POLYCHLORINATED METHYL-PHENOXYMETHYLPHENOIS (PREDIOXINS)
DURING CHLORINATION OF METHYLPHENOIS IN DILUTE AQUEOUS SOLUTION,
Tokyo Univ. (Japan). Faculty of Pharmaceutical

For primary bibliographic entry see Field 5B. W87-00793

CHEMICAL CHANGES OF ORGANIC COM-POUNDS IN CHLORINATED WATER: XI. THIN-LAYER CHROMATOGRAPHIC FRACTIONATION OF AMES MUTAGENIC COM-POUNDS IN CHLORINE-TREATED 4-METH-YLPHENOL SOLUTION, Tokyo Univ. (Japan). Faculty of Pharmaceutical Sciences

For primary bibliographic entry see Field 5B. W87-00794

INVESTIGATIONS ON THE PREVALENCE OF HETEROPHYES SPECIES IN TWELVE POPULATIONS OF THE FIRST INTERMEDIATE HOST IN EGYPT AND SUDAN,

Boohum Univ. (Germany, F.R.). Abt. fuer Sperial Zoologie und Parasitologie. H. Taraschewski. Journal of Tropical Medicine and Hygiene, Vol. 88, No. 4, p 265-271, August 1985. 1 fig, 1 tab, 24

Descriptors: *Sudan, *Snails, *Egypt, *Heterophyes, *Epidemiology, *Public health, Infection, Heterophysisis, Pirenella, Trematodes, Diseases, Saline users.

Saline water.

Twelve populations of the mud anail Pirenella conica from the densely populated Nile Delta, saline inland waters, and the scarcely populated coast of the Red Sea were investigated for the prevalence of Heterophyes heterophyes, H. acqualis, and H. dispar. Heterophyes heterophyes was most prevalent in the Nile Delta, which seems to be the center of human heterophylasis throughout the distributional range of that species. Transmission occurs near human settlements, where the definitive hosts are abundant. However, compiled data from infected intermediate and definitive hosts show that the prevalence of H. heterophyes in the Nile Delta is declining. The two other heterophyes species of the Near East, which have not yet been recorded from humans, were absent (H. dispar) or almost absent (H. acqualis) from the Nile Delta, where they had been found frequently in the 1950s. However, they occurred at the coast of the Red Sea. (Author's abstract) W87-00809

SYSTEM DYNAMICS APPROACH TO PIPE NETWORK ANALYSIS, Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Agricultural Engineering. For primary bibliographic entry see Field 8B. W87-00828

5G. Water Quality Control

ANALYSIS AND REVISION OF A RESERVOIR WATER QUALITY MODEL,

Group 5G—Water Quality Control

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. J. H. Wlosinski, and C. D. Collins. Interim Report. Technical Report E-85-13, No-vember 1983. 97 p, 7 fig, 6 tab, 22 ref, 4 append.

Descriptors: *Reservoirs, *Water quality control, *Model studies, CE-QUAL-R1, Water resources development, Water quality models, DeGray Lake, Arkansas, Statistical analysis, Graphical analysis, Computer models, Algae, Zooplankton, Dissolved solids, Nitrogen, Inorganic carbon, Oxygen, Hydrogen ion concentration.

CE-QUAL-R1 is a one-dimensional model that is being developed by the Corps Engineers to predict and assess the effects of engineering activities on reservoir water quality. Evaluation consisted of tests of the code and comparisons of model predic-tions with field measured values. Tests of the code included evaluations of the stability of predictions, included evaluations of the stability of predictions, conservation of mass, time step comparisons, entries of initial values, use of different driving variables, and a check of equation dimensionality. Evaluations of model predictions were made using data collected in 1979 and 1980 at DeGray Lake, a Corps of Engineers multipurpose project located in the Ouachita Mountains in south-central Arkansas. Calibration data were collected in 1979, and confirmation data were collected in 1979, and confirmation data in 1980. Both graphical and statistical tests were used for comparing model predictions with measured values. Variables used in this study were: algae, zooplankton, dissolved organic matter, orthophosphate-phosphorus, ammonia nirogen, niritie plus nitrate nitrogen, inorganic carbon, oxygen, pH, alkalinity, and dissolved solids. This report includes an evaluation of different variables, processes, and algorithms that were ent variables, processes, and algorithms that were changed in order to provide a model whose pre-dictions more closely fit measured values. (Author's abstract)

CONTROL OF GROUND WATER CONTAMI-

CONTROL OF GROUND WATER CONTAMI-NATION AT AN ACTIVE URANIUM MILL, Earth-Fax Engineering, Inc., Murray, UT. R. B. White, and R. B. Gainer. IN: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 97-115, 12 fig. 1 tab, 26 ref.

Descriptors: *Groundwater pollution, *Uranium, *Mine wastes, *Mine drainage, *Water pollution control, Water supply, Groundwater quality, Geologic fractures, Tailwater, Planning, Aquifers, Hydraulic properties, Pumping tests, Utah, Dakota-Burro Canyon.

Seepage from tailings ponds associated with an active uranium mill in Utah has resulted in contamination of groundwater contained in the Dakota-Burro Canyon Formation. This aquifer is used in the area as a supply for domestic and industrial wells. Results of very-low-frequency industrial weins. Results of very-low-frequency electromagnetic surveys and groundwater quality investigations at the site indicated that the flow of groundwater and contaminants is primarily fracture controlled. Pumping tests were conducted to determine the hydraulic characteristics of the fractured system. The extent of contaminant migration was then determined using an analytical model of transport in fractured aquifers. Based on these intransport in racurred adjusters. Based on these measurements and remediate past groundwater contamination. This plan consists of pumping from a single well intersecting the main fracture that transports contaminants off the site. The effectiveness of the plan was analysically received. was analytically modeled, taking account of the anisotropy of the groundwater system. Subsequent monitoring of water levels in the area indicates that the plan has been effective since its inception in November 1983. (See also W87-00049) (Author's

PERMITTING THE MERCUR GOLD MINE TAILINGS POND, Getty Mining Co., Salt Lake City, UT. B. W. Buck.

IN: Proceedings of the Association of Ground

Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 116-128, 5 fig, 3 tab, 5 ref.

Descriptors: *Mine wastes, *Gold, *Mercur Gold Mine, Utah, *Path of pollutants, Water pollution control, Permits, Legal aspects, Linings, Seepage control, Clay.

control, Clay.

The approach taken by Getty Mining Company to gain governmental approval of the new tailings pond at its Mercur Gold Mine at Mercur, Utah is described. The tailings were examined to identify the potential contaminants and their release pathways in order to design the facility's pollution control features. Potential treatment techniques to eliminate the contaminants of concern were reviewed and impoundment seepage control was selected as the only reasonable pollution control technique applicable. The physical properties of the tailings indicated that the settled tailings solids could provide a significant degree of seepage control. A design was adopted which would maximize the seepage control properties of the tailings and the rate of seepage release was then modeled. The effects of dilution, dispersion and chemical attenuation on the potential seepage plume were investigated and considered to be unpredictable in the complex geologic setting of the site. The original design of the facility was not acceptable to the state permitting agency which recommended that a synthetic liner be installed. A review of various liner materials indicated that contruction of a clay liner utilizing local clay material upgraded with bentonite would result in the required level of seepage control and the construction permit was granted. (See also W87-00049) (Author's abstract) W87-00053

USE OF SODIUM SULFIDE TO RESTORE AQUIFERS SUBJECTED TO IN SITU LEACH-ING OF URANIUM ORE DEPOSITS, Battelle Pacific Northwest Labs., Richland, WA.

attelle Pacific Northwest Labs., Richland, WA. V. J. Deutsch, L. E. Eary, W. J. Martin, and S. B.

McLaurine.
IN: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 129-153, 12 fig. 3 tab. 24 ref. NRC Contract No. DE-AC06-76RL0 1830, NRC FIN B2379

Descriptors: *Sodium sulfide, *Aquifer restoration, *Leaching, *Uranium, Confined aquifers, Sediments, Oxidation, Oxidation-reduction potential, Chemical reduction, Arsenic, Selenium, Molybde-

In situ leach mining of uranium involves the injection of leaching solution into a uranium ore zone situated in a confined aquifer. The uranium minerals are oxidized and dissolved, yielding a soluditon with a high uranium concentration. This solution is with a nigh uranium concentration. I his solution is pumped to a surface treatment plant where the uranium is removed and the solution is refortified with an oxidizer and is reinjected into the ore zone. At the termination of mining, the quality of groundwater in the ore-zone aquifer must be returned to its original level or a condition predetergroundwater in the ore-zone adulter must be re-turned to its original level or a condition predeter-mined by the permitting agency. Commonly used restoration techniques include groundwater sweep-ing and recirculation of fresh water through the leached ore zone; however, such techniques intro-duce oxidizing waters into the ore zone. To immo-bilize the redox-sensitive elements and restore the aquifer sediments as well as the groundwater, it has been suggested that a reducing agent be circulated through the leached ore zone during restoration. Laboratory studies indicate that sodium sulfide ef-fectively lowers the redox potential of the solution to the point that relatively insoluble minerals that contain the redox-sensitive elements (arsenic, sele-nium, uranium, and molybdenum) are stable. For some batch experiments, the uranium concentra-tion of the solution decreased by more than three orders of magnitude, from 44 to 0.04 ppm. The experimental results indicate that the addition of sodium sulfide to restoration solutions should cause the chemical reduction of the leached sediments, the chemical reduction of the leached sediments, thereby helping to reestablish the original redox condition of the aquifer. It is expected that such a process will produce long-term stability of the

groundwater/sediment system and lead to a more complete restoration of the aquifer. (See also W87-00049) (Lantz-PTT) W87-00054

GROUND WATER ASSESSMENTS UNDER THE RESOURCE CONSERVATION AND RE-COVERY ACT,

ital Protection Agency, Denver, CO. Region VIII.

In: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 227-236, 12 ref.

Descriptors: *Groundwater as Descriptors: "Groundwater assessment, "Resource Conservation and Recovery Act, "Groundwater pollution, Groundwater management, Waste man-agement, Hydrogeology, Hydrologic properties, Groundwater quality, Legislation, Legal aspects.

Groundwater quality, Legislation, Legal aspects.

Groundwater quality, Legislation, Legal aspects.

Groundwater contamination is one of the major environmental issues of the 1980's. Agencies at all levels of government, as well as industry and environmental groups, have focused their attention on this vital resource. Environmental Protection Agency (EPA) regulatory policies and the process of determining the extent of groundwater contamination present at hazardous waste disposal sites regulated under the Resource Conservation and Recovery Act (RCRA) Title 40 Code of Federal Regulations (CFR) Part 265 were the focus of discussion. After a brief regulatory overview, strategies for meeting the Part 265 requirements were discussed. Three major categories of information are necessary for the regulatory agency to review the assessment plan adequately. The first is facility waste information which includes the limits of the waste management area, locations and history of waste implacement, the physical and chemical characterization of the waste material, as-built drawing of waste containment units, and finally the as-built design of any man-made structures which would change the hydrologic conditions at the site. The second is information pertaining to the hydrogeologic units, their hydrologic properties, and their chemical properties. The third category would be details on how the rate and extent of contamination was determined and information on all field methods used to collect data, well design and construction techniques, sampling, analytical procedures, and quality assurance techniques. (See also W87-00049) (Lantz-PTT)

PREVENTING GROUND WATER CONTAMINATION FROM UNDERGROUND STORAGE TANK SYSTEMS,

Environmental Protection Agency, Denver, CO. Region VIII. N. J. Muillo.

IN: Proceedings of the Association of Ground Water Scientists and Engineers: Western Regional Ground Water Conference, January 15-16, 1985, Reno, Nevada. 1985. p 237-266, 9 fig. 1 tab, 13 ref.

Descriptors: *Groundwater pollution, ground storage, "Underground waste disposal,
"Leakage, Chemical wastes, "Site selection, Public awareness, Water pollution control.

Due to economic and technological trends, and the automotive boom, industrial chemical and petrochemical manufacturing increased in the 1950's through 1980's. At most plants and small service stations, the majority of tanks used to store various products, reagents and by-products were made of carbon steel. A small subgroup, including stainless steel, plastic, and fiberglass reinforced plastic (FRP), has been used increasingly in recent years. Estimates of the total number of underground storage tanks (chemical and petro-chemical) in the U.S. vary from 1.5 million to over 2.5 million. Estimates of the proportion of tanks that are leak-U.S. vary from 1.5 million to over 2.5 million. Estimates of the proportion of tanks that are leaking vary from 3% to as high as 25%. Many of these tanks, which are located below grade, have gone beyond their expected service life and if not leaking now, will be very soon. Leaking underground storage tanks have become a major nation-

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al concern. In the case of chemical storage tanks, the recent explosion and lethal poisoning of over 2000 people in Bhopal, India was a direct result of leaking undergound chemical storage tanks. This paper provides a general discussion about the types of problems encountered in underground tank systems, considerations regarding a specific site for tank storage, and why this information is needed. Much of the information presented, here, concentrates on the need for monitoring wells for new and existing underground storage tank systems. The main emphasis is directed toward bringing environmental problems related to underground ank systems to the attention of the reader so that awareness, more than specific expertise, is heightened. As regulatory action is taken, more published and manufactured material will be available to assist in practically addressing the problems of underground storage system. (See also W87-00049) (Lantz-PTT) (Lantz-PTT) W87-00059

ENVIRONMENTAL IMPACT STATEMENT ENVIRONMENTAL EVALUATIONS: WET-LIMESTONE-SCRUBBER RESEARCH PROJECT, WIDOWS CREEK UNIT 8.
Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology. For primary bibliographic entry see Field 6G. W87-00068

DESIGN AND INSTALLATION OF MOUND SYSTEMS FOR WASTE TREATMENT, North Carolina State Univ. at Raleigh. Dept. of For primary bibliographic entry see Field 5D. W87-00077

PROTECTION OF WATER QUALITY WITHIN THE EUROPEAN ECONOMIC COMMUNITY. Commission of the European Communities, Brussels (Belgium).

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 3-11, 18 ref.

Descriptors: "Water pollution control, "Water quality control, "Policy making, Public policy, Environmental protection, Environmental policy, Industrial wastes, Oil pollution.

dustrial wastes, Oil pollution.

Protection of water quality within the Community forms part of the protection of the whole environment. In 1973, the Council of Ministers adopted a policy for the environment, and reaffirmed this in 1977. Within this framework the Commission of the European Communities presents proposals for directives and decisions, and implements those which the Council has adopted. This paper has set out the ways in which the European Community seeks to protect water quality, by identifying and establishing directives concerning: (1) dangerous substances, (2) water quality and water quality monitoring, (3) industrial pollution, and (4) oil pollution. The rate of progress is slow but much has been achieved. Above all, there is now a public awareness that water, and indeed all the environment, cannot be taken for granted. They must be protected actively. The question is how much are prepared to pay to enjoy the benefits of a clean environment. Nearly all the actions that might be contemplated must be taken locally, and usually as part of a national policy. The role of the Community is to coordinate these actions and to ensure that there is a consistency of approach. (See also W87-00127) (Lantz-PTT)

USE OF DISSOLVED OXYGEN MODELLING RESULTS IN THE MANAGEMENT OF RIVER QUALITY: CASE HISTORY OF THE WILLAM-ETTE RIVER, OREGON,

D. A. Rickert.
IN: Effects of Water Disposal on Groundwater
and Surface Water, IAHS Publication No. 139,
1982. Proceedings of a Symposium held during the
First Scientific General Assembly of the IAHS at

Exeter, England, July 19-30, 1982. p 13-22, 3 fig, 2

Descriptors: *Dissolved oxygen, *Model studies, *Water quality management, *Willamette River, Oregon, Rivers, Municipal wastewater, Wastewater treatment, Biological oxygen demand, Water quality standards, Ammonia.

In 1973 the U.S. Geological Survey initiated a study of the River Willamette, Oregon to determine: (a) the major causes of dissolved oxygen (DO) depletion, and (b) whether advanced treatment of municipal wastewaters was needed to achieve the DO standards. The study showed that the off survey of achieve the DO standards. The study showed that rates of carbonaceous decay were low (k sub r = 0.03-0.06/day) and that point source BOD loadings accounted for less than one-third of the satisfied oxygen demand. Nitrification of industrially discharged ammonia was the dominant cause of DO depletion. The study led to the calibration and verification of a steady state DO model which was used to examine selected scenarios of BOD loading, ammonia loading and flow augmentation. In 1976, the modelling projections for the River Willamette were presented to resource managers and y 1980, Oregon had (a) decided that neither tertiary nor advanced secondary treatment was needed for municipal wastewaters, (b) instituted an effluent standard on the major discharger of ammonia, and (c) acknowledged the need for flow augmentation to maintain DO standards during the summer. (See also W87-00127) (Author's abstract)

HYDROLOGICAL ASPECTS OF SEALING WASTE TIPS WITH LINERS AND SOIL

COVERS,
Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen (Netherlands).
J. Hoeks, and G. J. Agelink.
IN: Effects of Water Disposal on Groundwater
and Surface Water, IAHS Publication No. 139,
1982. Proceedings of a Symposium held during the
First Scientific General Assembly of the IAHS at
Exeter, England, July 19-30, 1982. p 157-167, 6 fig,
1 tab, 10 ref.

Descriptors: "Sealants, "Land fills, "Waste tips, "Linings, "Soil covers, Leaching, Groundwater pollution, Soil sealants, Hydrological aspects, Seepage, Hydrologic models, Loam, Clay, Sand,

Groundwater contamination near waste tips can be reduced by sealing the tip at the upper and/or bottom side. In a large scale field experiment on the alope of a waste tip a soil cover with a low permeable loam layer was tested. In spite of the low saturated conductivity of 2 mm/day (= 0.00000023/ms) seepage through the loam layer amounted to more than 300 mm for an entire winter period. The field data did show a good agreement with results of hydrological model calculations. According to these calculations the saturated conductivity of a sealant must be less than 0.02 mm/day (= 0.0000000023/ms) if the infiltration rate of rainwater into the waste tip is to be reduced to less than 50 mm/year. This means that natural materials like loam or clay are not suitable reduced to less than 50 mm/year. This means that natural materials like loam or clay are not suitable for sealing a waste tip, neither at the top nor at the bottom. Various alternative materials were tested in the laboratory and in lysimeters. It appeared that sand-bentonite mixtures with about 15 weight-% of bentonite did satisfy the low conductivity requirement. (See also W87-00127) (Author's abstract) W87-00140

COUNTRYWIDE STUDY OF RIVER WATER QUALITY FOR GREAT BRITAIN, Department of the Environment, Reading (England). Water Data Unit. For primary bibliographic entry see Field 7C. W87-00144

DETERMINISTIC SIMULATION MODEL TO AID SELECTION OF MANAGEMENT STRAT-EGIES FOR COMBATING MINERAL POLLU-TION IN THE PRETORIA-WITWATERSRAND-

Stewart, Sviridov and Oliver, Marshalltown (South Africa). C. E. Herold.

C. E. Herold.

IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 245-254, 5 fig. 2 tab, 12 ref.

Descriptors: *Simulation analysis, *Water pollu-tion control, *Minerals, Water management, Water pollution sources, Total dissolved solids, Vaal River, South Africa, Salinity, Industrial water.

The Pretoria-Witwatersrand-Vereeniging (PWV) complex depends for its water supply on the River Vaal, which is also the sink for much of the pollution emanating from the region. With the onset of the rainy season, accumulated salts are washed off the catchment, causing unacceptably high total dissolved solids (TDS) peaks in the primary water source. The salinity build-up is compounded by the feedback effect as effluents are recycled into supply. A suite of numerical models having meteorological data as basic input has been developed to simulate daily or monthly TDS concentrations at key points in the system for any specified conditions of demand or catchment developed conditions of demand or catchment development. Parameters relating TDS levels to economic costs are used to determine the benefits to be derived from adopting one or other of many different water resource management and pollution control strategies. This work is still in progress and it is not the purpose of this paper to anticipate the outcome of the study. The models and methodologies that have been evolved are, however, sufficiently and the state of the study. The models and methodologies that have been evolved are, however, sufficiently and the state of the study. outcome of the study. The models and metanogoi-gies that have been evolved are, however, suffi-ciently generalized to find wider application. In particular the tentative relationship established be-tween industrial water consumption and diffus-source salt generation provides a valuable starting point for predicting likely future pollution levels. (See also W87-00127) (Lantz-PTT)

OPTIMAL WATER MANAGEMENT STRATE-GIES FOR SALINITY CONTROL, Central Soil Salinity Research Inst., Karnal (India).

N. K. Tyagi.

Journal of Irrigation and Drainage Engineering,
JIDEDH, Vol. 112, No. 2, p 81-97, May 1986. 6
tab, 4 fig. 21 ref.

Descriptors: *Salinity, *Irrigation, *Capital, India, Bhakra Canal System, Land levelling, Groundwater pumping, Aquifers, Return flow.

er pumping, Aquifers, Return flow.

Multi-objective linear programming modes! have been formulated to evaluate the water management strategies for salinity control. The water management strategies for salinity control. The water management strategies essentially aim at minimizing irrigation return flow (IRF) through structural rehabilitation of the irrigated system. The models have been applied to a part of the area irrigated by the Bhakra Canal System in Haryana, India. The optimal management strategies at a 70% reductin in IRF include: improving surface water application methods through precision land levelling and better design of irrigation layout (46%); groundwater pumping by shallow tubewells from fresh and marginally saline aquifers (28%); the lining of government controlled canals in State I (14%); and the introduction of a combination of surface and sprinkle irrigation methods in the ratio 75:25% (12%). Appreciable increase in benefits from IRF reduction up to 70% is possible, without any increase in investment, if cost-minimizing strategies are substituted by those maximizing benefits under the constraint of minimized cost. However, for the complete elimination of irrigation return flow, capital investments will have to be substantially enhanced. In most of the irrigation system rehabilitation programs, availability of capital is one of the major constraints. (Alexander-PTT) major const W87-00195

GROUNDWATER QUALITY TODAY AND TO-

Miljoeministeriet, Copenhagen (Denmark). For primary bibliographic entry see Field 5B.

Group 5G-Water Quality Control

W87-00247

ACID RAINMAKERS, For primary bibliographic entry see Field 6E. W87-00278

PROPOSED STRATEGY FOR REDUCING SULPHATE DEPOSITION IN NORTH AMERICA - I. METHODOLOGY FOR MINIMIZING SULPHUR REMOVAL, Atmospheric Environment Service, Downsview

Atmospheric Environment Service, Downsview (Ontario). J. W. S. Young, and R. W. Shaw. Atmospheric Environment ATENBP, Vol. 20, No. 1, p 189-199, January 1986. 5 fig, 7 tab, 12 ref.

Descriptors: "Acid rain, "Air pollution control, "Sulfate deposition, "Sulfar removal, "North America, "Acid deposition, Emission reductions, Air pollution, Water pollution control.

Four schemes to reduce sulphate deposition in N America while minimizing sulfur removal were tested. These schemes utilized the source-receptor linkages, as described by the source-receptor matrices produced by long range atmospheric transport models, and selected source areas where emission reductions were to have taken place. All four schemes indicated that most of the emission reductions should have taken place in the Ohio River Valley, northern Appalachia, the lower Great Lakes region and the St. lawrence River Valley. The tests indicated that fluctuations in matrix elements had little effect upon the choice of the most important source regions but affected only the ments nau intre errect upon the choice of the most important source regions but affected only the selection of the emission reductions in the less important fringe areas. Improved input data with respect to source-receptor relationships and control technology resulted in a refined methodology. (see also W87-00298) (Author's abstract) W87-00297

PROPOSED STRATEGY FOR REDUCING SULPHATE DEPOSITION IN NORTH AMER-ICA - II. METHODOLOGY FOR MINIMIZING

COSTS, Atmospheric Environment Service, Downsview (Ontario). R. W. Shaw.

Atmospheric Environment ATENBP, Vol. 20, No. 1, p 201 - 206, January 1986. 5 fig, 1 tab, 6 ref.

Descriptors: *Acid rain, *Air pollution control, *Sulfur deposition, *Sulfur, *Cost minimization, *North America, *Emission reductions, Cost effectiveness, Cost analysis, Atmospheric pollution.

A method was developed to determine the optimized emission reductions to reduce sulfate deption in N America such that the cost of the miss reductions tends to be minimized. The method combines the use of source-receptor relationships produced by long range transport models and cost data for control steps at smelters, thermal generat-ing stations and for fuel oil desulfurization. Emis-sion reductions selected by this method costed less sion reductions selected by this method costed less than those indicated by an optimization method which minimized only the amount of sulfur removed. Greater savings were achieved when the costs of the various control steps were spread over a wide range and were not clustered about a mean value. In that case, the control costs, especially in the early to middle steps of the control program, might only be a fraction of what they would otherwise be. (See also W87-00297) (Author's abstract) stract) W87-00298

RECOVERY OF PREVIOUSLY ACIDIFIED LAKES NEAR CONISTON, CANADA FOL-LOWING REDUCTIONS IN ATMOSPHERIC SULPHUR AND METAL EMISSIONS, Toronto Univ. (Ontario). Inst. for Environmental Statistics

T. C. Hutchinson, and M. Havas. Water, Air, and Soil Pollution WAPLAC, Vol. 28, No. 3/4, p 319-333, April 1986. 5 fig, 3 tab, 48 ref.

Descriptors: *Acid rain, *Acidity, *Air pollution effects, *Heavy metals, *Sulfur, *Lake restoration.

Hydrogen ion concentration, conductivity, Sulfates, Copper, Nickel, Cobalt, Manganese, Zinc.

fates, Copper, Nickel, Cobalt, Manganese, Zinc. The rate of recovery of acidified lakes located near the town of Coniston was assessed following the abrupt reduction in atmospheric sulfur dioxide and metal emissions at the Coniston smelter which closed in 1972. The water chemistry of several lakes was studied over a period of 16 yr (1968-1984). In one extremely acidic lake close to the smelter, the pH increased from 4.05 in 1972 to 5.8 in 1984. Conductivity, as well as concentrations of SO4, Cu, Ni, Co, Mn, and Zn decreased 60 to 90 % in the lake water during the same period. In another initially less acidic lake nearby, the increase in pH was less dramatic, while the decrease in conductivity, SO4, and some metals was similar to that of the more acidic lake. Local SO4 deposition decreased 75% while copper and nickel deposition decreased by 90% following closure of the smelter. These results indicate that even severely acidified lakes can improve within a few years following a substantial reduction in atmospheric sulfur emissions, and that in some regions recovery can occur due to reductions in sulfur dioxide emissions even in the absence of concurrent nitrogen oxide control. (Author's abstract)

ENVIRONMENTAL FATE OF MERCURY DIS-CHARGED INTO THE UPPER WISCONSIN

RIVER, Wisconsin Univ.-La Crosse. River Studies Center. For primary bibliographic entry see Field 5B. W87-00348

COMPLIANCE AND POLICY ISSUES AND RECOMMENDATIONS RELATED TO REVISION OF THE NATIONAL INTERIM PRIMARY DRINKING WATER REGULATIONS FOR RADIONUCLIDES, Alabama Rural Water Association, Montgomery. For primary bibliographic entry see Field 5F. W87-00413

LINEAR STOCHASTIC OPTIMIZATION AP-PLIED TO BIOCHEMICAL OXYGEN DEMAND - DISSOLVED OXYGEN MODEL-LING

Waterloo Univ. (Ontario). Dept. of Civil Engineer-

D. H. Burn, and E. A. McBean. Canadian Journal of Civil Eng CJCEB, Vol. 13, No. 2, p 249-254, April 1986. 2 fig, 3 tab, 15 ref.

Descriptors: *Model studies, *Mathematical models, *Stochastic process, *Biochemical oxygen demand, Water quality, Optimization, Wastewater,

A methodology for reflecting stochastic consider-ations in an optimization model which uses chanceconstrained programming, is applied to water quality management problems wherein concern is with the interaction between biochemical oxygen demand (BOD) and the dissolved oxygen (DO) concentration in a river. The uncertainty in the problem is embodied in transfer coefficients for which a lognormal distribution is derived from moment estimates made by first-order uncertainty analysis. The appropriateness of the lognormal dis-tribution is confirmed by results from a simulation modeling exercise. (Author's abstract) W87-00446

EXPERIENCE IN THE CONSTRUCTION AND RECLAMATION AND REVEGETATION OF HYDRAULIC-FILL SPOIL BANKS AT BERE-

ZOVYI LOG, V. M. Pavlenko, V. M. Alypov, N. P. Kravchenko, and Y. P. Gorbatov. Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 489-493, March 1986. 2 fig. 1 tab, 1 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 32-35, September 1985.

Descriptors: "Hydraulic mining, "Hydraulic fill, "Spoil banks, "Revegetation, "Land reclamation, Spoil disposal, Mine wastes, Water demand, Water

Hydraulic strip mining successfully used at the Kursk Magnetic Anomaly mines has stripped more than 310 million cu m of overburden from 1957 to 1983. The operation of hydraulic-fill spoil banks, tailings ponds, and cinder dumps shows that envi-1983. The operation of hydraulic-fill spoil banks, tailings ponds, and cinder dumps shows that environmental protection measures and multipurpose use of natural resources are of paramount importance. Adverse effects include wind erosion of cinder dumps, nonreturnable losses of water due to seepage and evaporation, hydraulic water needs, pollution of natural water bodies by wastewater, and removal of large land areas from agricultural use for a long time. The consolidation of liquified rock mass has been accelerated by surcharge with a porous material, sand in particular, but also concentrator tailings and cinders. This has increased the load capacity of the spoil bank and accelerated revegetation of its surface. A reserve water storage area which receives run-off water has decreased pollution of the river and lessened the need to use river water for the hydraulic mining. (McFarlane-PTT) W87-00454

LONG JOURNEY FROM DISCOVERY TO CLEAN-UP OF SUPERFUND SITES, Ecology and Environment, Inc., San Francisco,

V. Nordhav, G. Shepherd, and K. L. O'Regan. Association of Engineering Geologists Bulletin, Vol. 23, No. 2, p 209-214, May 1986. 1 fig.

Descriptors: *Superfund, *Resource Conservation and Recovery Act, *Legislation, *Comprehensive Environmental Resource Compensation and Lishility Act, *Environmental Protection Agency, *Cleanup, Hazardous waste, Arizona, Contamination, Alluvium, Groundwater management, Monitoring wells, TCE.

The process from discovery to clean-up of a Superfund site is traced as demonstrated by work currently in process at the Indian Bend Wash site in the Phoenix, AZ metropolitan area. The site is unique among other Superfund sites because it encompasses 12 square miles and includes several assist that the secretarially reserves the for ground. parties who are potentially responsible for ground-water contamination within its boundaries. The site water contamination within its boundaries. The site is located within a regulated groundwater management area that is characterized by severe groundwater overdraft problems due to the extensive use of groundwater for drinking, irrigation, and industrial water supplies. (Michael-PTT)

WATER DIVERSION AT LOW LEVEL WASTE DISPOSAL SITES

Oak Ridge National Lab., TN. Environmental Sci-

E. C. Davis, R. G. Stansfield, L. A. Melroy, and D. D. Huff.

Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 111, No. 5, p 714-729, October 1985. 7 fig. 2 tab, 12 ref. DOE Contract DE-AC05-840R21400.

Descriptors: *Radioactive waste disposal, *Water pollution control, *Pollution abatement, *Surface drainage, *Solid waste disposal, *Surface runoff, Path of pollutants, Subsurface drainage, Waste dumps, Storm runoff, Hazardous materials, Water table, Waste management, Drainage systems, Drains, Radioactive wastes.

Shallow depth to groundwater, surface drainage, and subsurface flow during storm events can cause major environmental problems in low-level radiomajor environmental problems in low-level radio-active waste management operations in humid re-gions. These problems were encountered at two waste disposal sites on the Oak Ridge Reservation. In September 1983, two similarly designed, engi-neered drainage projects were initiated at the dis-posal sites. The SWSA 4 (solid waste storage area four) project was designed to divert surface runoff and shallow subsurface flow originating upslope of the site away from the disposal area. The second project, a passive French drain constructed in SWSA 6, was directed strictly toward suppressing the site water table, thus preventing its intersection with the bottoms of disposal trenches. Postcon-

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struction monitoring for performance evaluation showed that the water table in the SWSA-6 area is suppressed to a depth > 4.9 m below the ground surface over 50% of the site, as compared to a depth of only 2.1 m for certain parts of the same area observed during seasonally wet months. The SWSA 4 project evaluation indicates that 56% of the winter-spring 1984 runoff was diverted around SWSA 4 via the drainage system. As a result of the reduced flow in the SWSA 4 tributary to White Oak Creek, a 44% reduction in 90-Sr flux from SWSA 4 was calculated. (Author's abstract) W87-00520

RIVER QUALITY MANAGEMENT UNDER STOCHASTIC STREAMFLOW, Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management. O. Fujiwara, S. K. Gnanendran, and S. Ohgaki. Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 2, p 185-198, April 1986. 3 fig, 5 tab, 11 ref.

Descriptors: "Water pollution control, "River basins, "Model studies, "Wastewater facilities, Stream quality, ReVelle models, Drought design, Management problems.

A chance-constrained model for the problem of finding the economically optimal treatment efficiency at each of several waste dischargers along a river basin while maintaining risks of stream quality violation in the different reaches below prescribed bounds is proposed. Streamflow is recognized as a random variable with a known probability distribution. Under a set of commonly made, but restrictive, assumptions, the stochastic formulation is equivalent to the ReVelle et al. model if the latter is used in conjunction with a certain rare drought design flow. The model can be considered an extension, to be applied to a more general class of river quality management problems. (Peters-PTT) PTT) W87-00588

ENVIRONMENTALLY BALANCED SUGAR REFINERY COMPLEX,
For primary bibliographic entry see Field 5D. W87-00591

MODELING OF PHYTOPLANKTON IN SAGINAW BAY: II. POST-AUDIT PHASE, Environmental Research Lab., Narragansett, RI. For primary bibliographic entry see Field 5B. W87-00602

PHOSPHORUS LOSSES IN RUNOFF AS AF-

FECTED BY TILLAGE, Wisconsin Univ.-Madison. Dept. of Soil Science. For primary bibliographic entry see Field 5B. W87-00607

DEHALOGENATION OF ETHYLENE DIBRO-MIDE BY NICKEL-SCHIFF BASE COM-POUNDS,

University of South Florida, Tampa. Dept. of Chemistry.

B. B. Martin, and D. F. Martin.

Journal of Environmental Science and Health (A) JESEDU, Vol. 20, No. 8, 1985. 1 tab, 11 ref.

Descriptors: *Dehalogenation, *Ethylene dibromide, *Nickel-Schiff base compounds, *Base compounds, Pollutants, Halogen removal, Water treat-

In Florida and other states, ethylene dibromide (EDB) has caused concern because of contamination of food and water supplies. The concern arose because of three factors: widespread use, physical properties, and concern for carcinogenicity. Ethylene dibromide has a good potential for accumulating in the environment because of comparatively low vapor pressure and high water solubility as well as enthusiastic use in agriculture. EDB contamination of ground water has been recognized, but the degree of contamination remains uncertain. In investigations of dehalogenation by coordina-

tion entities that may serve as useful models for future dehalogenation agents, bromide released in methanolic solutions of ethylene dibromide (5mM) was measured after six hours at room temperature and 62 C. Bromide release was enhanced (two-fold at 30 C, relative to a blank) in the presence of a nickel (II) chelate compound, bis (N-a-butylsalicylaldiminato) nickel (II). Firstly, bromide release was enhanced in the presence of diamine release compound. Second, the presence of diamine (without nickel-chelate compound) had an effect on bromide release compared to the blank runs. Third, the combination of diamine and nickel-chelate compound showed enhanced bromide release relative to nickel-chelate compound alone at 23 C. A previous study involving chloroform had suggested and metal-chelate assisted dehalogenations. Subsequent research has confirmed this dual mechanism. The present results with EDB, while limited, are encouraging because, they suggest that a metal-chelate compound alone can enhance bromide release, and second, they open up possibilities for design of better dehalogenating metal-chelates. (Khumbatta-PTT) PTT W87-00676

EVOLUTION OF DRINKING WATER REGU-LATIONS IN THE UNITED STATES, Johns Hopkins Univ., Baltimore, MD. Dept. of Environmental Health Engineering.

K. Kawata.

Journal of Environmental Health JEVHAH, Vol. 48, No. 4, p 206-209, January-February 1986. 17

Descriptors: *Drinking water, *Water quality standards, *United States, *Potable water, Water quality, Water law, Public health.

The national drinking water regulations in the U.S. have evolved over the past seven decades. Over these decades what were federal standards, enforceable only on supplies involved with interstate commerce, gave way to national regulations covering all but the very small water supplies serving limited numbers of individuals. Today in most instances the mandatory limits are based on lifetime consumption, and short periods of excursions are permitted with public notification. Water quality criteria were introduced with the 1962 Public Health Service Drinking Water Standards and they have since been updated by the Safe Drinking Water Committee of the National Academy of Science. Review of the criteria shows that the requirements of the National Academy of Science. Review of the criteria shows that the regulations are inconsistent. Some have large safety margins, while others are right at the edge. Today, considerations for economic factors and assessment in terms of human risks, rather than safe/unsafe, are part of the approach. (Khumbatta-DTT)

HYDRAULIC TRAP FOR PREVENTING COL-LECTOR WELL CONTAMINATION: A CASE STUDY

SIUDY, Alberta Univ., Edmonton. Dept. of Geology. D. U. Ophori, and R. N. Farvolden. Ground Water GRWAAP, Vol. 23, No. 5, p 600-610, September-October 1985. 10 fig. 1 tab, 28 ref.

Descriptors: *Well pollution, *Water pollution control, *Collector wells, *Forwell aquifer, *Hydraulic traps, Waste disposal, Water contamination, Groundwater pollution, Trap efficiency.

The Forwell induced infiltration well field supplies about 6,818.4 cu m/day of water to the cities of Kitchener-Waterloo, Ontario, something less than 10% of the total demand. Several development processes have been undertaken to improve production. Presently horizontal collectors inducing infiltration from the Grand River have been developed. Also, canals have been dug around each collector to enhance infiltration and stabilize the cone of influence. The waste disposal site of the old Breslube petroleum refinery plant, which lies to the east of the well field is a potential threat to the quality of water pumped from the collectors. A hydraulic trap in the form of a purge well was proposed for the Forwell collector well K-71. The

trap which protects well K-71 from contamination by contaminants migrating downgradient from the old Brealube waste disposal site, was based on a qualitative flow net obtained from a finite-element model of the Forwell Aquifer. The uniqueness of the trap lies in its simplicity and relatively low cost. The proposed trap would be operated on physical rather than chemical principles. (Khum-batta PTT)

INFLUENCE OF PH, ALUMINUM, AND ORGANIC MATTER ON STREAM INVESTE-BRATES,

Michigan State Univ., East Lansing. Dept. of Zoology. For primary W87-00704 rimary bibliographic entry see Field 5C.

BLUE NILE HEALTH PROJECT: A COMPREHENSIVE APPROACH TO THE PREVENTION AND CONTROL OF WATER-ASSOCIATED DISEASES IN IRRIGATED SCHEMES OF THE

SUDAN, Blue Nile Health Project, Wad Medani (Sudan). A. A. El Gaddal.

Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 47-56, April 1985. 7 fig, 1 ref.

Descriptors: "Public health, "Diseases, "Irrigation, Water quality control, Infection, Blue Nile River, Sudan, Pesticides, Drugs, Water pollution control, Water quality.

This is a general report on the Blue Nile Health Project in the Sudan. The project was started in 1979 to develop better strategies for controlling the major water-associated diseases in tropical irrigation schemes. The 10-year program will cost about 154 million dollars (1978 prices). The Gezira, Managil and Rahad irrigation systems, all irrigated from the Blue Nile River, were selected for the project areas as typical of irrigation systems throughout Africa and the Middle East where malaria, diarrheal diseases and schistosomiasis are endemic, and as the areas most urgently in need of disease control in the Sudan. The methods used for control of the water-associated disease emphasize permanent improvements in water supply and sanitation, in environmental and agricultural practices, on health education, community participation and primary health services, and a reduction in dependence on pesticides and drugs. (Author's abstract) W87-00712

FOCALITY AND SEASONALITY OF SCHISTO-SOMA MANSONI TRANSMISSION IN THE GEZIRA IRRIGATED AREA, SUDAN,

Institute for Tropical Medicine, Khartoum (Sudan). Schistosomiasis Research Project.

A. Babiker, A. Fenwick, A. A. Daffalla, and M. A.

Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 57-63, April 1985. 4 fig, 3 tab, 7 ref.

Descriptors: *Diseases, *Schistosomiasis, *Sudan, *Gezira, Water quality, Irrigation, Snails, Chemotherapy, Public health, Infection, Seasonal varia-

In the Gezira Irrigated Area of Central Sudan, tranmission of Schistosoma mansoni was shown to be geographically focal, being concentrated near villages and small settlements. In a study during 1981 and 1982 of the entire area around a typical Gezira village almost 90% of the Biomphalaria pfeiffer is nails carrying schistosome infections were found in one minor channel near the village. Sites near smaller settlements some distance from the minor canals yielded few infected snails. The factors involved in the prevalence of infection in the snails were temperature, turbidity and human contact with the snail habitat. A strategy was proposed for control of Schistosoma transmission through focal and seasonal mollusciciding, health education, chemotherapy, improved water supply and latrine distribution. (Author's abstract)

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SNAILS AND AQUATIC VEGETATION IN GEZIRA IBRIGATION CANALS, Institute for Tropical Medicine, Khartoum (Sudan), Schistosomiasia Research Project. A. M. H. Hilali, L. A. Desouqi, M. Wassila, A. A. Daffalla, and A. Fenwick. Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 75-81, April 1985. 1 fig. 5 tab, 9 ref.

Descriptors: *Gezira, *Irrigation canals, *Schisto-Descriptors: "Oezira, 'Irrigation canais, 'Scinsto-somiasis, 'Snails, 'Aquatic plants, 'Water quality control, Floating plants, Submerged plants, Epide-miology, Canals, Mollusks, Population density, Ec-ological distribution, Public health, Water quality.

nor canals in a limited area of the Gezira All 35 minor canas in a minted area of the Octain Irrigated Area were surveyed four times over a 2-year period to determine the types and distribution of squatic and semi-squatic vegetation. A more detailed 2-year study of the correlation between detailed 2-year study of the correlation between snail density and aquatic vegetation was carried out in 18 of these canals. A total of 22 different species of weed were recorded, with floating and submerged weeds being more widespread and dense in the clear, slow-moving water at the end of the irrigation season in March/April than in the turbid flood waters in October. The schistosome vector snails Biomphalaria pfeifferi and Bulinus truncatus were found in conjunction with aquatic weeds, and B. pfeifferi in particular incressed in numbers as weed growth continued. In the second season of the study, when mechanical weed clearing and regular focal mollusciciding was being carried out, there was a noticeable reduction in ing and regular rocal mollusciciding was being carried out, there was a noticeable reduction in weed density although repopulation was rapid. Snail numbers were reduced by mollusciciding and/or weed clearance in four canals, but outside the focal target canal stretches the weed clearance alone did not substantially reduce the snail populations. tions. (Author's abstract) W87-00715

PROTECTION OF SUDANESE IRRIGATION WORKERS FROM SCHISTOSOME INFEC-TIONS BY A SHIFT TO EARLIER WORKING

Blue Nile Health Project, Wad Medani (Sudan). O. Tameim, K. M. Abdu, A. A. El Gaddal, and W. R. Jobin.

Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 125-130, April 1985. 3 fig, 2 tab, 7 ref.

Descriptors: *Diseases, *Schistosomiasis, *Irriga-tion, Public health, Infection, Sudan, Timing, Gezira, Labor.

Although schistosomiasis is an important occupa-tional hazard for irrigation workers in Central Sudan, few measures have been found to protect them. In an attempt to reduce their exposure to the large numbers of schistosome cerariae encountered large numbers of schistosome cerariae encountered in the water at midday, a group of Gezira canal cleaners were shifted to early morning working hours after being cured of their infections. They left the water each day at 10.00 hours, working from the canal banks thereafter. At the end of 6 months the prevalence of infections with Schistosoma mansoni was much lower in this group than in a similarly treated group with normal working achedules, indicating a particular way to protect irrigation and agricultural laborers. (Author's abstract) stract) W87-00716

LUNGFISH PROTOPTERUS ANNECTANS (OWEN) AS A BIOCONTROL AGENT AGAINST SCHISTOSOME VECTOR SNAILS, Institute for Tropical Medicine, Khartoum (Sudan). Schistosomiasis Research Project. A. A. Daffalla, E. E. Elias, and M. A. Amin. Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 131-134, April 1985. 3 tab, 12 ref.

Descriptors: *Protopterus, *Biocontrol, *Schisto-somiasis, *Snails, *Lungfish, Aquatic life, Popula-tion growth, Fish, Ecological effects.

Laboratory and small-scale field experiments were carried out to study the malacophagous capabilities of the lungfish Protopterus annectans. When individual fish were offered a range of aquatic fauna in

aquaria in the laboratory only snails and dragonfly larvae were consumed. When offered a choice, the fish appeared to prefer snails, with larger individuals (up to 300mm) capable of consuming up to 200 snails per day. The introduction of five P. annectans into a snail concrete pond (diameter 5 m) with an established fauna and flora resulted in a reduction in the snail population of over 90% within 2 weeks. This reduction was maintained over a 4 month observation period suggesting that in habitats in which the lungfish can survive, there is a possibility of significant snail control. (Author's abstract) W87-00717

SURVIVAL, GROWTH AND REPRODUCTION OF THE IMPORTED AMPULLARID SNAIL MARISA CORNUARIETIS IN CENTRAL SUDAN,

Blue Nile Health Project, Wad Medani (Sudan). A. A. M. Haridi, S. H. El Safi, and W. R. Jobin. Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 135-144, April 1985. 6 fig. 8 tab, 4 ref.

Descriptors: *Snails, *Sudan, *Schistosomiasis, *Population dynamics, Ponds, Growth rates, Sur-vival, Puerto Rico, Path of pollutants.

The ampullarid snail Marisa cornuarietis was imported to the Sudan in 1981 for evaluation as a biological control agent against the planorbid snails which transmit human schistosomes. In initial field studies in small protected ponds the gen-eration time of M. cornuarietis was 4 months, as in eration time of M. cornuarietis was 4 months, as in Puerto Rico. The snails reached 4 cm in diameter after 1 year, compared to 3 cm in Puerto Rico. Their population density varied from 60 to 175 snails per meter of shoreline, compared to a similar pond in Puerto Rico where the stable density was about 115 snails per meter. The proportion surviving after 1 year was 0.03, less than the annual proportion surviving of 0.10 in Puerto Rico. The preliminary results therefore indicated that the ampullarid snails could establish strong populations in permanent habitats in central Sudan where there was adequate food, although it might take longer than it does in Puerto Rico. (Author's abstract) W87-00718 W87-00718

ESTIMATED RISKS AND BENEFITS FROM INTRODUCING MARISA CORNUARIETIS INTO THE SUDAN,

INTO THE SUDAN, Blue Nile Health Project, Wad Medani (Sudan). A. A. M. Haridi, and W. R. Jobin. Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 145-151, April 1985. 2 fig, 6 tab, 9 ref.

Descriptors: *Public health, *Sudan, *Biocontrol, *Schistosomiasis, Snails, Mollusks, Ecological effects, Marisa cornuarietis, Population dynamics, Nile River, Irrigation

It has been proposed that the tropical American ampullarid snail Marisa cornuarietis be used in the Sudan as a biological control agent against schistosomiasis. An estimate was made of the potential ecological hazards which might result from its widespread distribution in the Nile River Valley, and also of the potential benefits. The only foreseeable hazard would result from its colonization of rice fields and subsequent crop damage. However, calculations on population dynamics indicated that Marisa cornuarietis would not be able to establish significant populations in rice fields in the Nile Valley as the flooded periods are too short. Thus the expected benefits of schistosomiasis control far outweigh any expected risks, and the ampullarid should be used in expanded field trials in the Gezira Irrigated Area as a control method for schistosomiasis. (Author's abstract) war-00719

MALARIA CONTROL IN THE GEZIRA-MAN-AGIL IRRIGATED SCHEME OF THE SUDAN, Blue Nile Health Project, Wad Medani (Sudan). A. A. El Gaddal, A. A. M. Haridi, F. T. Hassan, and H. Hussein.

Journal of Tropical Medicine and Hygiene, Vol. 88, No. 2, p 153-159, April 1985. 7 fig, 1 tab, 4 ref.

Descriptors: *Malaria, *Sudan, *Public health, *Gezira, Epidemiology, Epidemios, Diseases, Irri-gation, Insecticides, Pesticides, Mosquitoes, Anopheles, Malathion, Fenitrothion.

The development of malaria control in the Gezira-Managil Irrigated Scheme of Central Sudan has gone through several phases. As a result of agricultural and irrigation practices in the Gezira, falciparum malaria transmission became perennial instead of seasonal, while the mosquito vector developed resistance to several insecticides. Subsequent failure to maintain control led to serious epidemics after 1971. By 1975, malaria was again put under control through an annual round of house spraying with malathion from 1975 to 1980, and with fenirothion since 1981. A proposal is outlined for a rational strategy for malaria control in the future. (Author's abstract) W87_00720

DEVELOPMENT IMPACTS ON WATER QUALITY: A CASE STUDY,

Najarian and Associates, Eatontown, NJ. T. O. Najarian, T. T. Griffin, and V. K.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 1, p 20-35, January 1986. 9 fig, 6 tab, 17 ref.

Descriptors: "Water quality, "Computer models, "Water resources development, Environmental effects, Pollution load, Model studies, STORM, New Jersey, Storm runoff, Pollution, Water quality

Water quality impacts of a proposed development in the environmentally sensitive Wigwam Creek. Mattix Run, and Morses Mill Stream Basins in Atlantic County, NI was studied. The study addressed short-term and and long-term impacts to surface and subsurface receiving waters. STORM (15), a USGS Runoff Model, was modified and used to derive the loadings of important water quality variables to surface and subsurface waters. The modified model was calibrated using data collected during a storm that had characteristics The modified model was calibrated using data collected during a storm that had characteristics similar to the historical severe storm. The model calibration provided assurances that the chosen pollutant accumulation rates are realistic and site specific. The short-term transient loading analysis indicates that the increases in pollutant concentrations in surface receiving waters are usually within the accuracy of measurement for the water quality parameters of interest. This is more evident when the results are analyzed for the post-development scenario with detention and retention controls implemented. The long-term 20 year simulations of runoff volumes in the watersheds under the three scenarios indicate that only a small fraction of the mean annual rainfall runs off directly to surface receiving waters. Furthermore, although substanscenarios indicate that only a small fraction of the mean annual rainfall runs off directly to surface receiving waters. Furthermore, although substantial increases in runoff volumes are predicted due to development, such increases are eliminated when proposed controls are assumed active. Long-term pollutant loadings to the surface waters remain practically unchanged from predevelopment conditions when the controls for runoff are operating properly. The detention and retention basins help remove total pollutant accumulation in the watersheds through settling of particulates in the runoff. Due to the high permeability of the total pollutant loads are delivered to the subsurface. This situations prevails under all of the scenarios considered in the present study. However, the analysis conducted here does not suggest that major alteration in such loadings are expected due to the proposed development, once the design controls are implemented and their proper operation is assured. (Author's abstract)

RESEARCH NEEDS IN URBAN STORM-WATER POLLUTION,

Florida Univ., Gainesville. Dept. of Environmental Engineering.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 1, p 36-47,

January 1986. 6 tab, 45 ref, append.

Descriptors: *Urban hydrology, *Research priorities, *Urban runoff, *Storm runoff, *Water pollution control, Monitoring water quality control Urban planning, Research priorities, Model stud

The results of an analysis of research needs in urban storm-water pollution control are presented. This assessment of needs is based on evaluation of the state of the art in four areas: urban runoff characterization, water quality effects, control effectiveness, and decision-making models. Over \$100,000,000 has been invested by the US EPA addressing this important question. The list of research needs is based on an extensive literature review of current research activities. Research needs related to characterizations include linking surface and subsurface phenomena, and automated monitoring systems. Research needs related to receiving water impacts, stress the need for benefitriak assessments for improved water quality standards. Multi-purpose wet and dry weather control units offer attractive possibilities as cost-effective systems. Finally, an improved procedure for calibrating models and using simulation models in engineering design are among several possibilities for better decision-making. (Author's abstract) W87-00738

WATER QUALITY MANAGEMENT FOR THE GREAT LAKES, Wayne State Univ., Detroit, MI. Dept. of Civil

wayne State Univ., Detroit, Mr. Dept. of Civil Engineering. T. M. Heidtke, and W. C. Sonzogni. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 1, p 48-63, January 1986. 5 fig, 2 tab, 28 ref.

Descriptors: *Water quality management, *Water quality control, *Great Lakes, Model studies, Mathematical models, Optimization, Water quality-tion control, Management planning, Water quality.

Results from a study of water quality planning and management alternatives for the Great Lakes are used to indentify cost-effective pollution control strategies. Mathematical models and other systems analysis techniques are applied to estimate pollutional loadings, specific water quality problem areas, costs and pollutant reductions offered through alternative management strategies. A determination of how these alternatives may be expected to achieve water quality objectives for the Great Lakes is made. Data from a diversity of Great Lakes research efforts are compiled, integrated, and used to project local and lakewide water quality conditions over the next twenty years. A set of management tools, including a nearshore water quality index and a series of environmental quality maps, are developed to promote nearshore water quality index and a series of envi-ronmental quality maps, are developed to promote communication and interpretation of Great Lakes water quality data among technical and nontechni-cal interests. Findings from the study support a staged approach to pollution control, whereby the most cost effective programs are implemented and their results assessed before more costly control measures are undertaken. (Author's abstract) W87-00739

CHALLENGES FOR WATER MANAGEMENT IN TUCSON, ARIZONA, Conservation Foundation, Washington, DC. P. C. Metzger.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 250-264, April 1986. 1 fig, 29 ref.

Descriptors: *Groundwater quality, *Water management, *Groundwater management, *Tucson, Arizona, Water supply, Contamination, Water quality control, Legislation, Economic studies, Competing use.

Tucson, Arizona is one of the nation's largest cities entirely dependent on groundwater for its water supplies. It faced a 1980 overdraft of over 60% of the area's total groundwater withdrawals. The quality of its diminishing supply is threatened by contamination but important efforts are being

made to solve these problems by municipal conservation, through Arizona's adoption of a stringent new Groundwater Management Act, and federal settlement of Indian water claims and construction of the Central Arizona Project. The competition among water users has not been eliminated, but a framework has been established for Tucson to end its overdrafts eventually. However, some major problems have not yet been resolved, including the socioeconomic impacts of water market solutions on Tucson area farmers and Indians, and groundwater contamination (primarily from copper mine tailings and trichloroethylene, TCE). Most important, fundamental issues of equity and carrying capacity are raised by the actions needed to provide water for Tucson's explosive growth in the midst of a desert. (Author's abstract) W87-00752

DREDGED-MATERIAL DISPOSAL SYSTEM CAPACITY EXPANSION,

Hydrologic Engineering Center, Davis, CA. D. T. Ford.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 277-291, April 1986. 7 fig, 2 tab, 25 ref.

Descriptors: *Waste management, *Waste disposal, *Dredging wastes, *Solid waste disposal, *Delaware River, Dredging, Land disposal, Rivers, Costs, Economic aspects, Model studies.

An ensemble of analytical tools is used to identify capacity expansion alternatives for the Delaware River dredged-material disposal system. Characteristics of the riparian and river areas are stored and studied with a geographic information system. Site attractiveness maps produced with these data yield an array of potential expansion sites. The least-costly schedule for acquisition of these sites is identified with branch-and-bound enumeration. For the enumeration, the operation cost of alternative expansion plans is evaluated with a network-flow programming model of the disposal system. (Author's abstract)

ENVIRONMENTALISTS TRY THE BACK-DOOR APPROACH TO TACKLING ACID

RAIN, R. L. Stanfield. National Journal, Vol. 17, No. 42, p 2365-2368, October 19, 1985.

Descriptors: *Acid rain, *Legislation, *Environmental policy, *Environmental protection, Environmental Protection Agency, Administrative agencies, Air pollution, Public participation.

After four years, Congress has been unable to pass acid rain legislation, so environmentalists have sued the Environmental Protection Agency to force them to use a strictur interpretation and enforcement of existing law to achieve the same results. Both sides agree that this backdoor administrative approach has created a host of problems resulting from its indirect nature and lack of integration. Meanwhile, industry is experimenting with new technologies to find less costly ways to reduce acid rain, and states are taking the initiative on their own control programs This might change the nature of the debate by transforming the economic incentives for opposing such control measures. The longest-running battle pits control of local pollution from electric utility smokestacks against regional pollution. State initiatives, clean coal technology, and backdoor administrative changes are moving very slowly to reduce the amount of acid rain, and Congressional staff members in favor of new legislation believe that nothing will happen on any front for the next three years. (Doria-PTT) W87-00764

MODELLING THE EFFECTS OF HYDROLO-GICAL CHANGES ON STREAM WATER ACID-

ITY, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 5B. W87-0829.

Techniques Of Planning-Group 6A

PRELIMINARY MODEL OF LONG-TERM CHANGES IN STREAM ACIDITY IN SOUTH-WESTERN SCOTLAND,

Virginia Univ., Charlottesville. Dept. of Environtal Scien

B. J. Cosby, P. G. Whitehead, and R. Neale. Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 381-401, May 30, 1986. 4 fig, 2 tab, 45 ref. NSF Grant CEE-8215914.

Descriptors: *Acidity, *Streams, *Soil chemistry, *Rock properties, *Scotland, *Remedies, *Mathematical models, Dargall Lane, Loch Dee, Galloway, Paleoecology, Hydrogen ion concentration, Long-term changes, Deposition rates, Chemical analysis, Salinity.

A modeling study was undertaken to investigate long-term changes in stream acidity in Dargall Lane, a sub-catchment of Loch Dee, in Galloway, southwestern Scotland. The model, which includes sea salt effects, is based on the assumption that surface water chemistry is determined by reactions taking place in the soils and rocks within a catchment. Stream chemistry data were used to calibrate the model and the model reproduced the declining pH levels of recent years as indicated by paleocological analysis. Stream acidity trends were investigated assuming two scenarios for future deposition. Assuming deposition rates are maintained at 1984 levels, the model indicates that stream pH is likely to continue to decline below presently measured values. A 50% reduction in deposition rates would likely result in an increase in the pH of the stream, although the pH will not return to estimated prescidification levels. (Author's abstract)

6. WATER RESOURCES **PLANNING**

6A. Techniques Of Planning

HYDROLOGICAL COMPUTATIONS FOR WATER RESOURCES DEVELOPMENT WITH INADEQUATE DATA, For primary bibliographic entry see Field 2A. W87-00124

MULTIPARAMETRIC SENSITIVITY ANALY-SIS OF ENERGY PRODUCTION PROJECTS, C I Power Services Ltd., Toronto (Ontario). J. P. Beaudry, and A. P. Langlois. Canadian Journal of Civil Engineering CJCEB, Vol. 13, No. 2, p 121-129, April 1986. 4 fig, 2 tab, 2

Descriptors: *Energy, *Systems analysis, *Sensitivity analysis, *Power plants, *Project planning Cost-benefit analysis, Multiparametric analysis Economic aspects, Optimization, Decision-making

Opimization studies of an energy production project or complex consist in determining the general dimensioning of the works during the prefeasibility studies. As these first studies are part of the iterative system planning process, they should include very exhaustive sensitivity analyses on the accuracy of all technical and economic parameters, although (and even because) so much data are uncertain during this phase. After a review of the mathematics of discounting and of the decision-making economic criteria, a nomographic approach is presented that allows the optimum dimensions of the project to be determined as a function of any combination of the following parameters: imposed discount rate, total investment cost, variations in cash flow pattern, delay in commissioning date, life expectancy of the works, monetary value of energy and power, system load growth, seasonal pattern of energy demand, effect of secondary energy, long-term average river flow, and effect of regulation on downstresm developgrowth, seasonal pattern of energy demand, effect of secondary energy, long-term average river flow, and effect of regulation on downstream develop-ments. (Master-PTT) W87-00439

Field 6-WATER RESOURCES PLANNING

Group 6A-Techniques Of Planning

PERFORMANCE EVALUATION OF ALTER-NATE POLICIES RESERVOIR SYSTEM OPER-

ATION, Waterloo Univ. (Ontario). For primary bibliographic entry see Field 4A. W87-00444

COMPUTERIZED DECISION SUPPORT SYS-TEMS FOR WATER MANAGERS, Colorado State Univ., Fort Collins, Dept. of Civil

Engineering.
J. W. Labadie, and C. H. Sullivan.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 299-

Descriptors: *Computers, *Water management, *Decision making, *Management planning, Cost analysis, Expert systems, Hydroelectric power, Irrigation, Water supply, Computer models.

An overview of several papers presented at a symposium on the application of computer-based decision support systems (DSS) for water resources management is presented. Topics covered include: structure, components, applications and benfits of DSS technology; the use of interactive simulation models for off-line training of water management personnel; dynamic programming as an optimization method for hydropower scheduling; computer control of irrigation systems; and, supervisory control and data acquisition systems for large, complex water projects. (Michael-PTT) W87-00468

WATER RESOURCE MANAGEMENT DECI-SION SUPPORT SYSTEMS, Colorado Univ. at Denver. Dept. of Civil Engi-

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 308-325, July 1986. 5 fig, 19 ref, append.

Descriptors: *Computers, *Water management. *Decision making, *Management planning, *Computer software, Water supply, Monitoring, Simulation, Computer models, Reservoir design, River basins, Regional planning, Radar, Microcomputers, Flood protection, Forecasting.

Water resources management decision support sys-tems are reviewed in terms of their current use and directions for future development. Microcomputer applications for regional water monitoring systems, applications for regional water monitoring systems, water supply and reservoir operations, computer-aided planning, regional weather observation and forecasting and knowledge-based expert systms are presented. Options for future development of water resources management decision support systems through enhancement of data and model susb-systems and dialogue management capabilities are also discussed. (Michael-PTT)

INTERACTIVE SIMULATION OF WATER RE-

NTERACTIVE SIMULATION OF WALES ASSOURCE SYSTEMS,
Montana State Univ., Bozeman. Dept. of Civil
Engineering and Engineering Mechanics.
A. B. Cunningham, and J. R. Amend.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 326338, July 1986. 11 fig, 1 tab, 6 ref. NSF 1SP2011440

Descriptors: *Computers, *Water management, *Simulation, *Computer models, *Management planning, Microcomputers, Decision making, Reservoirs, Water supply.

The application of interactive computer simulation as a decision support tool for the management of complex water systems is examined. Interactive computer simulation can, in certain circumstances, enhance the effectiveness of the more traditional simulation and optimization modeling techniques. Simulator technology and system modeling applications are described. A case study involving the Madison River Simulator is also presented. It is concluded that the interactive simulation approach

to water resource system analysis is useful for developing guidelines and philosophy for operat-ing moderately complex systems, and as a training tool for system operation personnel. (Michael-PTT) W87-00470

DYNAMIC PROGRAMMING IN HYDROPOW-

DYNAMIC PROGRAMMING IN HYDROFOW-ER SCHEDULING, Acres International Ltd., Niagara Falls, NY. R. B. Allen, and S. G. Bridgeman. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 3, p 339-353, July 1986. 12 fig. 2 tab, 16 ref.

Descriptors: *Computer programs, *Hydroelectric power, *Control systems, *Load dispatch, *Sched-uling, *Water use efficiency, Reservoirs, Electric ower rates, Electric power production, Computer nodels, Peak demand.

Dynamic programming optimization techniques were demonstrated in three case studies of hydropower scheduling involving analysis of an operating strategy for instantaneous, hourly and monthly time frames. The case studies addressed: (1) optimal instantaneous scheduling of units with different generating characteristics to maximize overall plant efficiency; (2) optimal hourly scheduling between two hydrologically linked power plants to maximize overall daily/weekly system efficiency; and (3) monthly scheduling to minimize the purchase cost of imported power subject to a time-of-day rate structure. (Michael-PTT)

USING COMPUTERS TO MANAGE IRRIGA-

USING COMPUTERS TO MANAGE IRRIGATION SYSTEMS, Science and Education Administration, Fort Collins, CO. Agricultural Research. For primary bibliographic entry see Field 3F. W87-00472

WINDY GAP PROJECT SCADA SYSTEM, Northern Colorado Water Conservancy District,

Loveland. J. Eckhardt

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 366-381, July 1986. 9 fig, 10 ref.

Descriptors: *Computers, *Control systems, *Colorado River, *Pumps, *Flow control, *Reservoirs, *Water use efficiency, Monitoring, Colorado, Cost analysis, Water transport, Reservoir storage, Diversion dams, Water rights, Electric power demand, Forecasting, Surface water records, Project planning, Scheduling, Remote sensing.

The objective of the control system of The Supervisory Control and Data Acquisition (SCADA) system of the Northern Colorado Water Conservancy District's Windy Gap Project is to maximize the amount of water diverted while minimizing the amount of water diverted while minimizing power costs and meeting operational constraints resulting from the complex legal, political, institutional and environmental compromise agreements reached to build the project. The basic hardware and software configurations of the system and interfaces with remote terminal units for data acquisition and control are described. The use of applications modules for real time control of four purpose and the downstream flow from the Window pumps and the downstream flow from the Windy Gap reservoir are also examined. (Michael-PTT) W87-00473

CENTRAL ARIZONA PROJECT SUPERVISORY CONTROL SYSTEM,

Water and Power Resources Service, Phoenix, AZ.

A.S. Gooch, and A. L. Graves. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 3, p 382-394, July 1986. 4 fig, 8 ref.

Descriptors: *Arizona, *Colorado River, *Control systems, Water transport, Computers, Flow control, Pumping plants, Aqueducts, Scheduling, Computer models, Water demand, Cost analysis,

Electric power demand, Peak demand, Monitoring, Forecasting, Controlled storage, Check structures, Canals, Hydraulic models, Remote sensing,

The Central Arizona Project (CAP) is designed to deliver much of Arizona's water for municipal, industrial and agricultural uses. The size and nature industrial and agricultural uses. The size and nature of the CAP requires use of a computer-based programmable master supervisory control (PMSC) system for operating the aqueduct. A dual computer master station is connected to remote terminal units at each plant, checkgate and turnout for sending instructions to and receiving information from any point along the aqueduct. Scheduling models, based on a constant volume philosophy of coperations, are used to generate pump, checkgate models, based on a constant volume philosophy of operations, are used to generate pump, checkgate and turnout schedules for the system. Optimization models can modify these schedules to take advantage of the less expensive off-peak power costs. The PMSC also monitors aqueduct depths and flows and compares them to those predicted in the scheduling models. (Michael - PTT) W87-00474

COMPUTER MODELS IN LOWER COLORA-DO RIVER OPERATION

Bureau of Reclamation, Boulder City, NV.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 395-408, July 1986. 9 fig.

Descriptors: *Colorado River, *Computer models, *Reservoirs, *Hydroelectric plants, *Flow control, Control systems, Legal aspects, Project planning, Scheduling, Remote sensing, Monitoring, Forecasting, Water records, Water conservation, Water

Three computer models used by the U.S. Bureau of Reclamation to monitor and forecast Lower Colorado River operations are examined. A 24 Month Study model is used for planning monthly and seasonal operations of the reservoir and powerplant system. Another model is used to plan and schedule releases for downstream water delivery, energy generation and flood control on a daily and weekly basis. The Supervisory Control and Data Acquisition (SCADA) computer model of the Western Area Power Administration is used by water schedulers to automatically control hourly releases for the next 24-hour day and for same-day changes at the Davis and Parker powerplants in Arizona. (Michael-PTT) W87-00475

TVA'S USE OF COMPUTERS IN WATER RE-SOURCE MANAGEMENT,

Tennessee Valley Authority, Knoxville. Div. of Air and Water Resources. B. W. Brown, and R. A. Shelton.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 3, p 409-418, July 1986. 5 fig.

Descriptors: *Tennessee Valley Authority, *Computers, *Computer models, *Water management, Decision making, Regional planning, Reservoirs, Flow control, Data acquisition, Water quality management, Flood forecasting.

The Tennessee Valley Authority uses computers and decision support systems as tools for daily operation of the reservoir system. The use of computers has allowed the collection and processing of a greater quantity of data and has provided rapid, cost-effective evaluation of a large number of operational alternatives. The close working relationships between computer system developers and the operational staff has contributed to success in implementing the computer-based decision-support system. A number of computer models are used for roperational planning, hydrodynamic modeling of rivers and reservoirs, water quality evaluation and compilation of flood data. (Michael-PTT) W87-00476

Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

LOOPED WATER DISTRIBUTION SYSTEM OPTIMIZATION FOR SINGLE LOADING, Indian Inst. of Tech., Bombay. Centre for Environmental Science and Engineering. For primary bibliographic entry see Field 5F. W87-00593

IMPROVING PERFORMANCE OF IRRIGA-TION/HYDRO PROJECTS, Colorado State Univ., Fort Collins. Dept. of Civil

Engineering.
J. C. Faux, J. W. Labadie, and R. C. Lazaro.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 205224, April 1986. 7 fig, 3 tab, 20 ref. NSF Project INT 8025750.

Descriptors: *Irrigation, *Water resources development, *Pampanga River *Hydroelectric planning, Project planning, Management planning, Philippines, Performance evaluation, Model stud-

Large-scale water resource projects must be operated and maintained so that the benefits for which they were built actually occur. The key to substantial improvements in project performance is operated and maintained so that the benefits for which they were built actually occur. The key to substantial improvements in project performance is operating the various project components in a comprehensive, integrated fashion. Optimal integration of a system's many facets and analysis of tradeoffs between conflicting objectives, requires the assistance of analytical tools to provide information on which to base management decisions. An interactive river basin network flow model called MODSIM2 has been developed for this purpose. MODSIM2 is applied to a large irrigation/hydropower system in the Philippines, while the upper Pampanga River Integrated Irrigation System (UPRIS) is in Central Luzon. Through use of the calibrated model, it was possible to: (1) locate a bottleneck in the conveyance system causing irrigation shortage; and (2) demonstrate that with integrated operations, firm energy generation can probably be increased up to four times the current level without causing irrigation shortage. (Author's abstract) W87_00749

6B. Evaluation Process

WATER RESOURCES DEVELOPMENT AND MANAGEMENT EFFORTS IN ASIA AND IN THE PACIFIC, Philippines Univ., Diliman, Quezon City. R. M. Lesaca. IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 85-96, 5 ref, 1 append.

Descriptors: *Water resources development, *Water management, *Asia, *Pacific, Economic aspects, Industrial development, Remote sensing, Computer models, Simulation analysis, Lover Mekong Basin, Laos, Vietnam, Thailand, Kampu-

The purpose of this paper is to describe significant attempts at water resource management undertaken in the Asia-Pacific region, in conjunction with both existing and foreseen needs; particularly in the mainstreams of Third World economies, based the mainstreams of Third World economies, based as they are on agriculture and the region's beginnings as a significant industrial sector. The operation and the nature of the predicted effectiveness of important water resource management programs introduced in the Asia-Pacific region is discussed. Existing situations and needs in various Asia-Pacific countries are reviewed to generate a clearer understanding of the importance of effective water resource management in the region. The focus of this examination is the increasing importance of remote sensing and the recent introduction of a computer simulation model of a resource system, using as an example the Nam Pong water system, using as an example the Nam Pong water resource development in the Lower Mekong basin. Suitability of various amall-scale water resource management programs, as well as the need for

comprehensive water management training programs in the region is mentioned. Finally, the paper attempts to present global water management activities undertaken by international organizations. (See also W87-00086) (Author's abstract) W87-00092

HYDROLOGICAL STUDIES OF THE IRRAWADDY DELTA, Halcrow (William) and Partners, Swindon (Eng-STUDIES OF THE land). For primary bibliographic entry see Field 2E. W87-00115

HYDROLOGICAL COMPUTATION FOR WATER RESOURCES DEVELOPMENT WITHIN IMO RIVER BASIN, NIGERIA, Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Civil Engineering. For primary bibliographic entry see Field 7C. W87-00120

HYDRO DEVELOPMENT IN LATIN AMERICA: A VIEW FROM IDB, Inter-American Development Bank, Washington, DC. Project Analysis Dept. D. A. Giampaoli.

D. A. Giampaoli.
International Water Power and Dam Construction,
Vol. 38, No. 6, p 13-14, June 1986.

Descriptors: *Hydroelectric power, *Economics, Agriculture, *Latin America, Inter-American Development Bank.

velopment Bank.

This article reviews the Inter-American Development Bank's policies in the power generation sector and trends for hydro expansion in Latin America. The Bank's (IDB) contribution to the electric power sector in Latin American has been strongly orientated toward hydroelectric development. Hydroelectric projects have spurred the creation and development of industries in Latin America. In addition, hydroelectric projects in many Latin American coutries have resulted in the formation of a pool of engineers qualified to work in other areas of national development. Economic integration has been encouraged by bi-national hydro schemes financed through IDB. One role of the IDB is to promote integration on a technical level in its small-scale technical cooperation program. Another IDB lending objective is improving living standards in rural areas. IDB's emphasis over the next decade in power generation projects will continue to be on hydroelectric plants in order to help ensure Latin America's energy future. to help ensure Latin America's energy future. (Main-PTT)
W87-00314

SIMULATING COST AND QUALITY IN WATER DISTRIBUTION,
Environmental Protection Agency, Cincinnati,
OH. Drinking Water Research Div.
For primary bibliographic entry see Field 6C.
W87-00501

CHALLENGES FOR WATER MANAGEMENT IN TUCSON, ARIZONA, Conservation Foundation, Washington, DC. For primary bibliographic entry see Field 5G. W87-00752

FIVE N.E. COMMUNITIES JOIN IN SEWER PROJECT, For primary bibliographic entry see Field 5D. W87-00767

PROFESSIONAL AND PUBLIC NATURAL RE-SOURCE MANAGEMENT ARENAS, Oregon Univ, Eugene. Dept. of Sociology. R. P. Gale, and M. L. Miller. Environment and Behavior, Vol. 17, No. 6, p 651-678, November 1985. 2 fig, 1 tab, 51 ref.

Descriptors: "Natural resources, "Manageme planning, "Forests, "Marine fisheries, Plannin Fisheries, Economic aspects, Environmen policy, Administrative agencies.

Modern natural resource management systems are defined by the interplay of natural resources, profit-seeking resource industries, management bureaucracies, and diverse publics. Forest policy involves the U.S. Forest Service and occurs in a professional management arena; fishery policy involves the National Marine Fisheries Service and affiliated Regional Fishery Management Councils, and is conducted in a public management arena. The two arenas differ in their organization of power, knowledge, and communication. The professional-public management arena model reinforces an image of a forest system that, compared to the fishery system, is more bureaucratically centralized and autonomous, more seasoned in supporting a scientific and technical infrastructure, and more sophisticated in its responses to diverse industrial and public interests. The forest management bureaucracy has been successful in securing its organizational survival and political base. This has been accomplished by resource management professionalism that relies on formal standard operating routines and the ethic of scientific resource management. In contrast, the fishery management bureaucracy appears strikingly responsive to industrial, public, and bureaucratic criticisms. This model is briefly extended to other natural resource management systems. (Doria-PTT)

HYDROLOGY OF TOMORROW, Polish Academy of Sciences, Warsaw. Inst. of Geophysics. Z. W. Kundzewicz. Hydrological Sciences Journal HSJODH, Vol. 31, No. 2, p 223-235, June 1986. 21 ref.

Descriptors: *Hydrology, *Political aspects, *Water management, *Economic aspects, *Projections, *Forecasting, Technology, Resources man-

Remarks on the progress of scientific hydrology in the coming decades are formulated, both by extrapolating recent trends in research into hydrology, and by isolating the present barriers to progress that are likely to remain at the center of interest of hydrological sciences. The likely progress of scientific hydrology depends on external and internal conditions. There has been no attempt in the present paper to forecast the political, economical, technological, demographical and social factors that will shape the needs that hydrology has to fulfill in the future. Instead, the development of hydrology is seen as the extrapolation of the existing tendencies in this area of science. It is likely that significant efforts will be undertaken to solve the problems considered today as barriers to development. The analysis of hydrological data and models in the perspective of their application could be an important future issue. (Lantz-PTT)

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST-EFFECTIVENESS OF THE U.S. GEO-LOGICAL SURVEY STREAM-GAUGING PRO-GRAM, ary bibliographic entry see Field 7A. For primar W87-00203

PROPOSED STRATEGY FOR REDUCING SULPHATE DEPOSITION IN NORTH AMERICA - II. METHODOLOGY FOR MINIMIZING Atmosphe (Ontario). eric Environment Service, Downsview

nary bibliographic entry see Field 5G.

SIMULATING COST AND QUALITY IN WATER DISTRIBUTION, Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div. R. M. Clard, and R. M. Males. Journal of Water Resources Planning and Manage-

Field 6-WATER RESOURCES PLANNING

Group 6C-Cost Allocation, Cost Sharing, Pricing/Repayment

nt (ASCE) JWRMD5, Vol. 111, No. 4, p 454-466, October 1985. 6 fig. 11 ref.

Descriptors: *Water supply, *Water supply development, *Water distribution, Water resources development, *Cost-benefit analysis, Cost analysis, Economic aspects, Model studies.

A spatial approach that disaggregates the water supply system into the components of acquisition-treatment and transmission-distribution, allows these components to be studied in isolation and in combination. Each of these components has different cost and physical functions and the cost and performance trade-offs between these functions can provide important insights into regionalization and cost-related issues. The Water Supply Simulation Model (WSSM) described here is a system of computer programs that allows for an evaluation of the physical and economic characteristics of a water distribution system in a spatial framework. The development of the model and its application to a case study situation is presented. (Author's abstract) abstract) W87-00501

6D. Water Demand

HYDROPOWER IN URUGUAY, Universidad de la Republica, Montevideo (Uru-guay). Hydraulic Inst. For primary bibliographic entry see Field 8C. W87-00317

CHARACTERISTICS OF LOSSES INCURRED FROM RESTRICTION OF WATER USE AND ELECTRIC POWER CONSUMPTION, S. B. Elakhovskii, S. I. Sorokina, and E. N.

Smirnova. Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 478-483, March 1986. 3 tab, 7 ref. Trans-lated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 25-28, September 1985.

Descriptors: *Water management, *Water use, *Water supply profiles, *Runoff forecasting, Hydroelectric power, Cost-benefit analysis, Economic

Loss problems arise as a consequence of river runoff variability, the absence of accurate runoff forecasting methods, and the economic inexpediency of selecting hydroelectric station parameters and other water-powered facilities, on the basis of the minimum possible inflow of water resources. Expenditures are forced, and planned measures put into effect before the occurrence of unfavorable factors for the purpose of climinating or mitigating or m into effect before the occurrence of unfavorable factors for the purpose of eliminating or mitigating their negative effects. Losses are the negative consequences occurring after the effect of random unfavorable factors. Economic losses are the cost expression of such consequences. Direct comparisons of specific losses of various water-management objects (industry, fishery, agriculture, etc) do not sufficiently indicate their competitiveness or preferable outcomes due to water restrictions. This can be achieved through the use of a mathematical model. (McFarlane-PTT) W87-00452

USING COMPUTERS TO MANAGE IRRIGA-

TION SYSTEMS,
Science and Education Administration, Fort Col-lins, CO. Agricultural Research.
For primary bibliographic entry see Field 3F.
W87-00472

CENTRAL ARIZONA PROJECT SUPERVISORY CONTROL SYSTEM,

Water and Power Resources Service, Phoenix, AZ. For primary bibliographic entry see Field 6A. W87-00474

MANAGING DROUGHT THROUGH TRIG-GERING MECHANISMS, Virginia Water Resources Research Center,

M. S. Hrezo, P. G. Bridgemen, and W. R. Walker. American Water Works Association Journal JAWWA5, Vol. 78, No. 6, p 46-51, June 1986. 1 fig. 5 tab, 10 ref.

Descriptors: *Drought, *Palmer index, *Regional planning, *Short term planning, *South Dakota, *Colorado, *Iowa, *Delaware, *New York, *Florida, *Kentucky, Available water, Flow measurement, Water ahortage.

Several states and regional commissions use triggering mechanisms to develop responses to drought-induced water shortages. The physical conditions that define drought and quantity water shortage conditions are presented. Each drought management plan is tailored to meet particular state and local conditions and each demonstrates the importance of coordinated planning for water shortage management before the onset of crisis conditions. (Michael-PTT) W87-00643

WATER SUPPLY SYSTEM MODELS WITH CAPACITY EXPANSION, International Development Center of Japan,

Tokyo. For primary bibliographic entry see Field 5F. W87-00741

6E. Water Law and Institutions

TRILOGY OF TRIBES V. FERC: REFORMING THE FEDERAL ROLE IN HYDROPOWER LI-CENSING.

Lewis and Clark Law School, Portland, OR. M.C. Blumm

Nac. 1, p 1-59, 1986. 309 ref. DOC Grant No. NA81AA-D-00086.

Descriptors: *Federal Energy Regulatory Com-mission. *Hydroelectric power, *Regulations, *Ju-dicial decisions, *Licensing, *Indian tribes, Legal review, Fisheries, Wildlife, Recreation, Cultural considerations, Legislation.

Three of the 34 lawsuits that had challenged the Federal Energy Regulatory (Commission's (FERC's) hydroelectric decisions by early 1984 were brought by Indian tribes (joined by environmental groups and in 2/3 by federal agencies) and all were decided within a month of each other in mid-1984. Together, they may significantly influence FERC's hydroelectric regulation. The effect of the Tulalip Tribes, Escondido Mutual Water Co., and Yakima Indian Nation decisions on FERC's hydroelectric power licensing authority is examined. The author concludes that, by rejecting FERC's attempt to expand exemptions to include new dams, requiring FERC to include conditions imposed by federal land management agencies on its licenses, and refusing to allow FERC to relicense projects while deferring fishery consideration, the three decisions inject a measure of pluralism into the hydroelectric authorization process. The cases could prompt FERC to develop some badly needed long-term planning and encourage greater sensitivity to previously underrepresented interests in fish, wildlife, natural, cultural, and recreational resources. The author, however, advocates congressional reforms to ensure that nonfederal hydroelectric development represents a fair balance between the need to generate electric power and the need to preserve free-flowing rivers. (Rochester-PTT) W87-00240

FEDERAL POWER ACT AND HYDROPOWER DEVELOPMENT: REDISCOVERING STATE REGULATORY POWERS AND RESPONSIBIL-

Skadden, Arps, Slate, Meagher and Flom, Washington, DC. M.C. Whittaker.

Harvard Environ ental Law Review, Vol. 10. No. 1, p 135-187, 1986. 284 ref.

Descriptors: "Federal Water Power Act, "Public Utility Regulatory Policies Act, "Hydroelectric power, "Judicial decisions, "Legislation, Legal review, State jurisdication, Federal jurisdiction, Regulations

This article examines the major legal doctrines relating to regulatory power over hydroelectric power development, explains the current perceptions of the balance between federal and state authority, and suggests why these perceptions may be wrong. Topics include: the Public Utility Regulatory Policies Act (PURPA) and the debate over development (the enactments and the current debate), the Federal Water Power Act of 1920 (FWPA, including regulatory powers predating the FWPA, and the FWPA), judicial interpretation of the FWPA (early cases, First lowa Hydro-Electric Cooperative, preemption, United States vs Appalachian Power Co., California vs United States (New Melones Dam), and applying preemption analysis), and regulatory structure and the small hydropower debate (state power, interference with state laws, and lack of coordination-public participation). (Rochester-PTT)

ACID RAINMAKERS.

R.L. Stanfield. National Journal, Vol. 18, No. 24, p 1500-1503, June 14, 1986.

Descriptors: *Legislation, *Acid rain, *Lobbying, *Political aspects, Citizen participation.

Factors leading to changing the votes of members of Congress on acid rain control legislation are discussed, including scientific studies, economic analyses, and lobbying efforts. Many people and groups have worked to bring Congressional attention to the acid rain issue; these include scientists at universities who reported the results of their studies on the complex biology, meteorology, and chemistry of acid rain; consulting firms whose economists projected the financial impact of acid rain control; Washington lawyers who represented affected industries and individual firms; trade associations; environmental organizations and the coacidations; environmental organizations and the coaanceten mustries and individual firms; trade asso-ciations; environmental organizations and the coa-litions they have formed; and citizens, companies, unions, and local interest groups. The relative im-portance of several lobbyists in forming Congres-sional opinion are discussed, with emphasis on how critical votes were obtained. (Rochester-PTT) W87-00278

HYDRO DEVELOPMENT IN LATIN AMER-

ICA: A VIEW FROM IDB,
Inter-American Development Bank, Washin DC. Project Analysis Dept.
For primary ibiliographic entry see Field 6B.
W87-00314 nt Bank, Washington,

LONG JOURNEY FROM DISCOVERY TO CLEAN-UP OF SUPERFUND SITES, Ecology and Environment, Inc., San Francisco, CA.

For primary bibliographic entry see Field 5G. W87-00486

WATER MONITORING NETWORKS IN COLD

CLIMATE REAS,
Institut National de la Recherche Scientifique,
Sainte-Foy (Quebec).
For primary bibliographic entry see Field 7A.
W87-00493

MANAGING DROUGHT THROUGH TRIG-GERING MECHANISMS, Virginia Water Resources Research Center, Blacksburg. For primary bibliographic entry see Field 6D. W87-00643

EVOLUTION OF DRINKING WATER REGU-LATIONS IN THE UNITED STATES. Johns Hopkins Univ., Baltimore, MD. Dept. of

Nonstructural Alternatives—Group 6F

Environmental Health Engineering. For primary bibliographic entry see Field 5G. W87-00679

WATER RESOURCES AND THE PUBLIC TRUST DOCTRINE, Nevada Univ., Reno. Dept. of Civil Engineering. J. W. Bird.

J. W. Ditt. Journal of Water Resources Planning and Manage-ment (ASCE) JWRMD5, Vol. 112, No. 1, p 64-70, January 1986. 18 ref.

Descriptors: *Water resources development, *Water rights, *Public trust doctrine, Public access, Public rights, Navigation, Legislation, Lake Michigan, California, Illinois, Coastal waters.

Michigan, California, Illinois, Coastal waters.

The expansion of the concept and application of the Public Trust Doctrine (PTD) to water rights and the attendant water resource is considered. The Public Trust Doctrine (PTD) to water rights and the attendant water resource is considered. The Public Trust Doctrine traditionally has been limited to lands over which the tides ebb and flow for commerce or other defined uses. The first application of PTD to inland waters/lands occured in Illinois to lands under Lake Michigan subject to tidal action. Since then, however, PTD has been applied to lands that are nontidal and, recently, to non-navigable waters (not lands). Recently in California, the State Supreme Court held that a Public Trust Easement' exists on the state's navigable waters and that this easement protects public trust values from being harmed by water rights appropriations. Recognizing that state law varies, the PTD also varies. At its present extreme in California, which may be followed or adopted by other states, the PTD designation may apply to: (1) Any coastal tidelands or foreshore of the coast suitable for trust purposes; (2) Land under navigable tidal waters, including that land that has become navigable due to flooding; (3) Foreshore or land bordering nontidal navigable waters; (4) Tributaries of navigable waters; (5) Areas subject to public trust uses including recreation and preservation; and, (6) Land whose title passed from the state or another owner (18) who recognized the public trust implications. In such a case the PTD may be applied. If the title passed from the US government or on nonpublic trust lands, then the lands may not be considered in public trust lands.

W87-00740

IMPLICATIONS OF SPORHASE IN WATER-RESOURCE PLANNING,

da Univ., Reno. Dept. of Civil Engineering.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 198-204, April 1986. 21 ref.

Descriptors: *Water resources development, *Leg-islation, Legal aspects, Water rights, Riparian

Conflicts occur between the commerce clause of the US Constituion and state statues that forbid the export of water to other states. In Nebraska versus Sporhase, such a conflict was examined and a farreaching decision was made. The US Supreme Court held that, except under narrowly defined conditions, it is illegal to apply a statute to prevent the movement of water from one state to another. Water is considered to be a form of commerce similar to wheat or steel. While state planning may be applied to water (its use and supply in the state), it cannot be used to prevent someone from out of state from appropriating water for out-of-state uses. (Author's abstract)

ENVIRONMENTALISTS TRY THE BACK-DOOR APPROACH TO TACKLING ACID For primary bibliographic entry see Field 5G. W87-00764

6F. Nonstructural Alternatives

FLOODS ON RICHLAND CREEK, LITTLE RICHLAND CREEK, BROYLES BRANCH,

AND AN UNNAMED TRIBUTARY TO BROYLES BRANCH IN DAYTON, TENNES-SEE, AND VICINITY. Tennessee Valley Authority, Knoxville. Office of Economic and Community Development. For primary bibliographic entry see Field 4A. W37-00004

EFFECT OF FLOODPLAIN REGULATION ON INLAND PORT FACILITIES.
Federal Emergency Management Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-169508, Price codes: Al8 in paper copy, A01 in microfiche. December 8, 1982. 404 p, 57 fig, 26 tab, 138 ref, 4

Descriptors: *Flood plain zoning, *Flood plain management, *Flood protection, Benefits, Legisla-tion, Public policy, Hydraulic properties, Flood damage, Floods, Flood control, National Flood Insurance Program.

Insurance Program.

The purpose of this study is to examine the relationship between the objectives of the National Flood Insurance Program and Executive Order 11988 and the need for the development of inland port facilities. The study is based upon the collection and analysis of available data pertaining to floodplain management legislation, flood insurance, flood losses, inland ports and port operations, mitigation measures, economics, hydraulics, and both perceived and experienced conflicts. Specifically, the objectives of this study are: (1) Provide an examination of the relationship between the objectives of the National Flood Insurance Program (NFIP) and Executive Order 11988 to reduce flood losses and the economic need for port and harbor facilities in the floodplain; (2) Determine if conflicts exist between NFIP regulations, E.O. 11988 requirements, and port facility development areas; (3) Identify alternatives that will minimize conflicts between NFIP regulations, E.O. 11988 requirements and port facility development needs while meeting the objectives of each; and (4) Provide an economic analysis of costs and benefits at the national, local and individual level of applying NFIP regulations and E.O. 11988 requirements to port facility development. To accomplish these objectives a work plan was developed which consisted of six related tasks. These are: (1) Work plan; (2) Data gathering; (3) Case study selection; (4) Collection of case study data, (5) Data analysis; and, (6) Generating reports. (Lantz-PTT)

OPTIMAL FLOOD CONTROL POLICY BASED ON IMPERFECT FORECASTS, Delhi Coll. of Engineering (India). Dept. of Civil

Engineering.

A. Kumar, and R. Devi.

IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg. West Germany, August 15-27, 1983. p
397-407, 1 fig, 15 ref.

Descriptors: *Flood control, *Flood forecasting, *Forecasting models, *Flood protection, Model studies, Short-term planning, Flood disaster management, Algorithms, Mathematical models.

A method is presented here, to evaluate the performance of a flood forecasting response system in an overall framework of flood disaster management. It is shown how the forecast and its related errors can be more accurately assessed by using an on-line adaptive filter algorithm. Uncertainties in the forecast are incorporated in a mathematical model which enables the optimal flood damage reduction strategies to be determined based on imperfect forecasts and the expected reduction in damage by taking an optimal decision. Short-term forecasting of floods is an important non-structural method of reducing flood damage. Based on a reliable forecasts, different measures can be initiated to reduce the loss of life and property. Extensive services of the structural method of the control of the structural method of reducing flood damage. Based on a reliable forecast, different measures can be initiated to reduce the loss of life and property. Extensive services are considered to the control of the control A method is presented here, to evaluate the per-formance of a flood forecasting response system in ed to reduce the loss of life and property. Extensive resources are presently being allocated in the collection and dissemination of hydrological infor-

mation in order to reduce flood damage by better forecasts. However, none of the forecasting models yields a perfect forecast due to various uncertaints which can be classified as (a) the model uncertainty, (b) the input uncertainty, (c) the parameter uncertainty, and (d) the initial state of the system uncertainty. In fact, forecast errors are considerable and are stochastic in character. A forecasting others in thesefore expired to interpretable thesefore expired to interpretable. able and are stochastic in character. A forecasting scheme is, therefore, required to issue, not only a quantitative T-h-shead forecast, but also the distribution of forecast errors. The need to issue accurate forecasts has accelerated the development of more elaborate forecasting models, the best-known being physically-based models, conceptual models, and stochastic models. (See also W87-00086) and stochast (Lantz-PTT)

LOWER MISSISSIPPI VALLEY FLOODS OF 1982 AND 1983,

Walk, Hydel and Associates, Inc., New Orleans LA.

For primary bibliographic entry see Field 2E. W87-00500

AVERAGE ANNUAL DAMAGE BY FLOOD FREQUENCY ZONE.

Southampton Univ. (England). Dept. of Geogra-

phy. N. W. Arnell. Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 1, p 104-113, January 1986. 4 fig, 1 tab, 22 ref.

Descriptors: *Flood damage, *Floods, Flood protection, Insurance, Flood frequency, Annual floods.

Average annual flood damage can be calculated individually for each flood-plain property, but a less time-consuming approach is to estimate average annual damage using a set of typical values for buildings in specific locations. By defining a range of depth-frequency relationships and calculating average annual damage for hypothetical structures located at fixed frequency levels, it is possible to construct a graph showing the variation of typical average annual damage for structures in specified frequency zones with the degree of flood hazard. Although damage estimates based on zonal annual damage may not be particularly accurate for individual properties, the sum of a number of estimates will more closely approximate aggregate flood damage. The method can, therefore, be used to make initial estimates of flood damage in a flood-plain, and furthermore it can be used as the basis for flood insurance premiums. (Author's abstract) W87-00742

FLOOD CONTROL BENEFITS REVISITED, Army Engineer District, Fort Worth, TX. D. J. Plazak.

Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 265-276, April 1986. 5 tab, 4 ref.

Descriptors: *Urban floods, *Flood damage, Costs, Model studies, Benefits, Flood protection, Structural models.

Examination of the frequency-damage method of estimating urban flood damage prevented benefits revealed sources of potential uncertainty and bias. Few of these potential problems have been adversed in detail in the literature. Some of the problems, such as use of the index point method, will probably wither as use of more powerful computers and software becomes more widespread. Several issues were identified which are not being addressed in current studies: (1) Bias resulting from inaccurate estimates of structure elevations; (2) failure to consider that unemployed labor may be used to repair flood damages; (3) failure to consider replacement of existing structures; and (4) underestimation of willingness to pay for repairs. These issues indicate areas in which analysis may need to be more careful and, in the latter two cases, in which additional research may yield important results. (Lantz-PTT)

Field 6-WATER RESOURCES PLANNING

Group 6F—Nonstructural Alternatives

W87-00753

6G. Ecologic Impact Of Water Development

STATUS OF ANADROMOUS FISHES IN SOUTHEASTERN U.S. ESTUARIES, Unity Coll., ME. Center of Environmental Studies. For primary bibliographic entry see Field 2L.

ANALYSIS AND REVISION OF A RESERVOIR WATER QUALITY MODEL,
Army Engineer Waterways Experiment Station,
Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W87-00037

ADVANCES IN ECOLOGICAL RESEARCH: VOLUME 12. Academic Press, London, England. 1982. Edited by A. MacFadyen and E. D. Ford. 252 p.

Descriptors: *Ecological effects, *Ecology, Ecosystem, Ecological distribution, Species diversity, Ecotypes, Lakes, Zoning, Zones, Aquatic plants,

Studies which indicate the variety of ecological research currently being conducted, at an ecological level between plant and animal biology, worldwide are presented. Chapters cover: 1) the ecology of the cinnabar moth; 2) the zonation of plants in freshwater lakes; 3) the evolutionary consequences of interspecific competition, and 4) landscape ecology as an emerging branch of human ecosystem science. (See also W87-00040) (Lantz-PTT)

POPULATION-LEVEL EFFECTS OF MULTI-PLE STRESSES ON FISH AND SHELLFISH, Oak Ridge National Lab., TN. Environmental Sci-

ences Div.

P. Kanciruk, J. E. Breck, and D. S. Vaughan.

Available from the National Technical Information
Service, Springfield, VA. 22161, as DE83-004235,
Price codes: A06 in paper copy, A01 in microfiche.
Report No. ORNL/TM-8317, November 1982.

Publication No. 1967. 121 p, 5 fig., 16 tab, 353 ref, 4
append. Contract No. W-7405-eng-26.

Descriptors: *Fish, *Shellfish, *Environmental stress, *Population dynamics, *Multiple stress, Fish populations, Experimental data, Toxicity, Fishing, Ecological effects, Survival, Water pollution ef-

Because the cumulative effects of many stresses may cause the collapse of a population even when the effects of each stress alone may appear insignificant, it is important to (1) document the effects of multiple stresses on fish and shellfish populations, (2) provide an overview of experimental data concerning the effects of multiple stresses on fish and shellfish, and (3) evaluate existing methods of quantificiar represents to multiple stresses. quantifying responses to multiple stresses. Stress refers to the environmental forces acting on an quantitying responses to multiple stresses. Stress refers to the environmental forces acting on an individual or population through changes in rates of survival, growth, or reproduction. The classification of stresses, population responses, and the terminology for interactions among stresses are discussed. A brief review of case histories for natural populations indicated that catastrophic changes in community structure and function can be induced by multiple stresses. In particular, fishing pressure can be a powerful agent reducing the capacity of populations to respond to stress. An overview of experimental studies that evaluated acute and chronic effects of two or more stresses on fish and fish populations highlights the need for studies that examine sublethal responses (i.e., growth and reproduction) to chronic exposures. Some of the theoretical approaches to multiple stresses on fish and fish populations are surveyed, including discussions of quantal responses, responses surface analysis, dose-response theory for multiple toxic factors, and certain ecological theories that may aid in an understanding of the effect

of multiple stresses on fish populations. Studies are needed that provide greater insight into the physiological mechanisms affected by the toxicant and reflected by the population responses of survival, growth and reproduction. (Author's abstract) 1827.0045. growth and W87-00045

IMPACTS OF CHANNEL RECONSTRUCTION IN THE PILCHUCK RIVER, Washington Univ., Seattle. Dept. of Civil Engi-

neering.

R. R. Horner, and E. B. Welch.

Available from the National Technical Information
Service, Springfield, VA. 22161, as PB83-171553,
Price codes: A02 in paper copy, A01 in microfiche.
Interim Report WA-RD-39.15, September 1982. 34
p, 2 fig, 6 tab, 6 ref, 3 append. Contract No. Y1804.

Descriptors: *Washington, *Ecological effects, *Channel improvement, *Pilchuk River, Substrates, Benthic environment, Particle size, Sediments, Fish, Bank erosion, Bank stabilization,

A five-year study was performed to compare con-ditions in the Pilchuck River before and after ditions in the Plichuck River before and after channel reconstruction associated with rerouting highway SR-2. The study focused on sediment particle-size analyses, benthic macroinvertebrates and fish, and demonstrated that a substrate compa-rable to the original was recovered within one year. Sampling of the benthic macroinvertebrate and fish communities was subject to temporal vari-tion unselsted to the construction, but the results and fish communities was subject to temporal vari-ation unrelated to the construction, but the results gave no indications of deterioration in diversity, gave no indications of deterioration in diversity, quantity or size in the reconstructed channel. These points are evidence that the design and construction of the new channel was relatively effective in promoting the development of favor-able habitat for juvenile anadromous salmonids, resident species, and their invertebrate food able habitat for juvenile anadromous salmonids, resident species, and their invertebrate food sources. Several factors exist which make it prudent to avoid stream rechanneling whenever possible. First, even with relatively careful design and construction, a period of time is required for recovery of a natural substrate. Second, steep bank slopes such as installed in the reconstructed Pilchuck channel, disrupt the relationship between the river and its flood plain. With slighter slopes, suspended particles and contaminants associated with them could be more effectively settled rather than transported in increasing concentrations downstream. Third, the upper portions of the Pilchuck bank slopes are not as well stabilized as portions closer to the normal water surface and may erode substantially in a future flood, especially on outside meanders. Finally, vegetation loss is on outside meanders. Finally, vegetation loss is aesthetically detrimental and may result in increased water temperatures and reduced fish productivity if extensive. (Lantz-PTT)

LONG-TERM HYDROLOGIC MONITORING PROGRAM: GNOME SITE, EDDY COUNTY, NEW MEXICO.

Department of Energy, Las Vegas, NV. Nevada Operations Office. For primary bibliographic entry see Field 5B. W87-00066

RESEARCH NEEDS TO ASSESS POPULA-TION-LEVEL EFFECTS OF MULTIPLE STRESSES ON FISH AND SHELLFISH, Oak Ridge National Lab., TN. Environmental Sciences Div. For primary bibliographic entry see Field 5C. W87-00067

ENVIRONMENTAL IMPACT STATEMENT ENVIRONMENTAL EVALUATIONS: WETLIMESTONE-SCRUBBER RESEARCH PROJECT, WIDOWS CREEK UNIT 8. Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology. Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-900198, Price codes: A04 in paper copy, A01 in microfiche. Report No. TVA/OP/EDT-82/61, 1982. 45 p, 5

fig. 15 tab. 20 ref.

Descriptors: *Environmental impact statement, *Environmental effects, *Widows Creek, Stevenson, Alabama, Flue gas desulfurization, Water pollution control, Wastewater pollution, Industrial wastewater, Ecological effects, Dissolved solids, Studen Canadas Sludge, Groundwater, Heavy metals, Trace ele-

In the 1970's TVA designed and installed a fullscale limestone flue gas desulfurization (FGD)
system for unit 8 off the Widows Creek Steam
Plant on the Tennessee River near Stevenson, Alabama. The 550-MW system was intended to be a
demonstration unit to provide information for this
and other possible FGD applications in the TVA
system. It has since been integrated into the oversall
emission control strategy for Widows Creek.
Before the system was placed in operation in May
1977 an extensive evaluation project was developed for startup and initial period of operation.
The project (TVA project authorization No. 3247)
contained provisions for evaluation of the environmental effects of the FGD system on the air and
water in the plant vicinity. This was identified as
task 6 of the ground and surface waters. The
specific objectives of this study were to confirm
the environmental impact statement for the project
in relation to water quality and nonfisheries aquatic
ecology. To implement these objectives, a program
of sampling and analysis was initiated that characterized the nature of the FGD system waste
streams, the effect of these streams on the existing
ash pond effluent and on groundwater in the disposal site vicinity, the mixing and transport of
FGD effluent discharged to the Tennessee River,
and the effect of these discharges on the river
biota. Among the results noted were: (1) No inorganic priority pollutants were significantly higher
(at the 90% confidence level) in the ash pond
effluent during two periods of FGD system operation as compared with an intervening 4-month
period in which the FGD system did not operate.
Total dissolved solids, calcium, magnesium, sulfate, and barium were significantly higher at a 99%
confidence level during both periods of FGD
system operation. All of the FGD sludge extracts
and the interstitial water were below the EPA
criteria for hazardous waste leachate, and (2) Soil
groundwater quality in the vicinity of the scrubber
pond was affected by chloride, sulfate,

FISH IN LAKE MICHIGAN: DISTRIBUTION OF SELECTED SPECIES, Michigan State Univ., East Lansing. Dept. of Ge-ography.

For primary bibliographic entry see Field 2H. W87-00078

REVIEW AND ANALYSIS OF EXISTING MODELING APPROACHES FOR ASSESSING POPULATION-LEVEL EFFECTS OF MULTI-PLE STRESSES ON FISH AND SHELLFISH, Oak Ridge National Lab., TN. Environmental Sciences Div.

D. S. Vaughan, R. M. Yoshiyama, J. E. Breck, and D. L. DeAngeli

Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-004175, Service, appringitett, VA. 22101, as DESTACTION, Price codes: A06 in paper copy, A01 in microfiche. Report No. ORNL/TM-8342, November 1982. Publication No. 1979. 153 p. 19 fig. 2 tab, 147 ref, 1 append. Contract No. 14-16-0009-80-1039.

Descriptors: *Model studies, *Population expo-sure, *Multiple stresses, *Fish, *Shellfish, Surplus production models, Yield models, Stock-recruit-ment models, Leslie matrix models, Bioenergetics

Network Design-Group 7A

The cumulative effects of multiple stresses on fish and shellfish populations may cause the collapse of a population even though the effects of a single stress may be insignificant. Several population modeling approaches are reviewed and compared for their usefulness in quantifying the aggregate effect of multiple sources of stress on populations. Specifically, ways are investigated to insert the effects of stress into five major modeling approaches: (1) surplus production models, (2) yield and yield-per-fecruit models, (3) tock-recruitment models, (4) Leslie matrix models modified to incorporate growth, and (5) bioenergetics models. For yield-per-recruit models, (3) stock-recruitment models, (4) Leslie matrix models modified to incorporate growth, and (5) bioenergetics models. For each modeling approach, the kinds of data required to implement the basic model and ways that the effects of stresses might be incorporated into the model structure are described. The assumptions, dynamics, estimation problems, advantages, and usefulness of the various modeling approaches are compared. The choice of a modeling approach depends, in part, on data availability. Surplus production models generally require the existence of a long time series of data, while yield-per-recruit, Leslie matrix, and bioenergetics models require extensive life-history and other data, some of which may be available in the literature. If information on the effects of a particular stress on a fish is limiting, then one of the simpler models may be adequate. If, however, more extensive knowledge of the effects of a stress is available, then the use of a more complicated model structure would generally be preferable. (Author's abstract)

HYDROLOGY OF HUMID TROPICAL RE-

International Association of Hydrological Sci-For primary bibliographic entry see Field 2A. W87-00085

NUTRIENT BALANCE OF A CENTRAL AMAZONIAN RAINFOREST: COMPARISON OF NATURAL AND MAN-MANAGED SYSTEMS, Frankfurt Univ. (Germany, F.R.). Dept. of Geosci-

W. L. F. Brinkman.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the
International Union of Geodesy and Geophysics,
Hamburg, West Germany, August 15-27, 1983. p
153-163, 2 fig, 4 tab, 21 ref.

Descriptors: *Nutrient balance, *Amazon River, *Rainforests, *Ecological effects, Land management, Water management, Calcium, Magnesium, Phosphorus, Nitrogen, Nutrient requirements, Hydrologic aspects, Hydrologic cycle, Tropical re-

The natural tropical rainforest systems of the Amazon basin are being rapidly converted into man-managed land-use schemes. The nutrient bal-ance of the natural 'terra firma' rainforest ecosystems on Tertiary formations in the central Amazon tems on Tertiary formations in the central Amazon displays a dynamic steady-state system with tightly closed biogeochemical cycles for calcium, magnesium, total phosphorus and total nitrogen. If transferred to man-managed systems on a large scale, the nutrient pool, primarily the organic compartment of the system, is diminished by burning which promotes excessive nutrient losses and the destruction of the root-map trap mechanisms which feed the nutrient return flow. As a consequence, large-scale moreculture demends on the quence, large-scale monoculture depends on the application of mineral fertilizers and pesticides, which in the long run causes a negative co-benefit balance for the region, both economical and ecologically. (See also W87-00086) (Author abstract) W87-00097

ASSESSING THE IMPACTS OF OPERATING HIGHWAYS ON AQUATIC ECOSYSTEMS, For primary bibliographic entry see Field 4C. W87-00208

COMMUNITY WATER SUPPLY AND SANITA-TION IN DEVELOPING COUNTRIES, 1970-

1990, AN EVALUATION OF THE LEVELS AND TRENDS OF SERVICES. Pan American Health Organization, Guatemala City.

For primary bibliographic entry see Field 5F. W87-00242

WATER QUALITY EFFECTS OF EXCAVA-TION AND DIVERSION, Army Engineer Waterways Experiment Station, Vicksburg, MS. Water Resources Engineering

Group.
For primary bibliographic entry see Field 5C.
W87-00590

SIMULATION OF MISSOURI RIVER BED DEGRADATION, Iowa Univ., Iowa City. Inst. of Hydraulic Re-

For primary bibliographic entry see Field 4A. W87-00628

BLUE NILE HEALTH PROJECT: A COMPRE-HENSIVE APPROACH TO THE PREVENTION AND CONTROL OF WATER-ASSOCIATED DISEASES IN IRRIGATED SCHEMES OF THE

SUDAN, Blue Nile Health Project, Wad Medani (Sudan). For primary bibliographic entry see Field 5G. W87-00712

DEVELOPMENT IMPACTS ON WATER QUALITY: A CASE STUDY,
Najarian and Associates, Eatontown, NJ.
For primary bibliographic entry see Field 5G.

ECOLOGICAL STUDIES ON FOUR RAINFOR-ESTS IN KARNATAKA, INDIA: I. ENVIRON-MENT, STRUCTURE, FLORISTICS AND BIO-

MASS, Sandal Research Centre, Bangalore (India). For primary bibliographic entry see Field 2I. W87-00798

7. RESOURCES DATA

7A. Network Design

TEMPORAL AND SPATIAL CONSIDERATIONS IN MEASURING ESTUARINE WATER FLUXES,

South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research. For primary bibliographic entry see Field 2L. W87-00008

GROUNDWATER RESOURCES: INVESTIGA-TION AND DEVELOPMENT, Hebrew Univ. of Jerusalem (Israel). Groundwater Research Center.

For primary bibliographic entry see Field 4B. W87-00041

APPARATUS FOR GROUND WATER CHEM-ISTRY INVESTIGATIONS IN FIELD CAIS-

Los Alamos National Lab., NM. For primary bibliographic entry see Field 2K. W87-00065

EVALULATION OF PROCEDURES FOR DE-TERMINING SELECTED AQUIFER PARAM-ETERS

ETERS,
Cold Regions Research and Engineering Lab.,
Hanover, NH.
C. J. Daly.
Available from the National Technical Information
Service, Springfield, VA. 22161, as AD/A125437,
Price codes: A06 in paper copy, A01 in microfiche.
CRREL Report 82-41, December 1982. 104 p, 9
fig, 1 tab, 149 ref.

Descriptors: *Aquifer testing, *Aquifer characteristics, *Parametric hydrology, Oroundwater, Piezometric head, Permeability, Flow pattern, Flow rates, Porosity, Storage coeffi-

Many of the important factors influencing the choice of appropriate aquifer test procedures are presented. The concepts of bias, accuracy and spatial variability are explained. The definitions of a number of aquifer parameters are developed from basic principles demonstrating the underlying assumptions and limitations. The parameters considered are: piezometric head, hydraulic conductivity/intrinsic permeability, flow direction, specific discharge magnitude, transmissivity, volumetric flow rate, total porosity, average linear velocity, storage coefficient, specific yield, dispersion coefficient-aquifer dispersivity. For each parameter, several techniques are described, evaluated and ranked in terms of perceived potential accuracy, simplicity and value to contaminant transport studies. It must be stressed, however, that the evaluations are based principally upon theoretical grounds, and not upon actual conduct of the described procedures. (Author's abstract)

LONG-TERM HYDROLOGIC MONITORING PROGRAM, AMCHITKA ISLAND, ALASKA. Department of Energy, Las Vegas, NV. Nevada Operations Office.

Operations Office.

Available from the National Technical Information Service, Springfield, VA. 22161, as DE83-004132, price codes: A03 in paper copy, A01 in microfiche. Report NVO-242, 1982. 26 p, 8 fig, 2 tab, 21 ref.

Descriptors: *Monitoring, *Hydrologic aspects, *Long-term planning, *Amchitka Island, *Radio-activity, Alaska, Tritium, Water pollution, Ecological effects.

The purpose of the Long-Term Hydrologic Monitoring Program for Amchitka Island, Alaska, is to obtain data that will assure the public safety, inform the public, the news media, and the scientific community relative to radiological contamination, and to document compliance with federal, state, and local antipollution requirements. Amchitka's geographical setting, climate, geology, hydrology, and ecology are described. Site history including event information for Long Shot in 1965, MILROW in 1969, and CANNIKIN in 1971 is described. Event related contamination has been observed only at the LONG SHOT site. At this site, tritium in concentrations below the drinking water standards has been observed in multiplis and wells in the area adjacent to surface ground zero. water statutarus has been observed in mun pits and wells in the area adjacent to surface ground zero. The Long-Term Hydrologic Monitoring Program for Amchitka is described. No radioactive venting, significant radioactive leakage, or bioenvironmen-tal damage resulted from any of the nuclear tests on Amchitka. (Author's abstract) W87-00080

COUNTRYWIDE STUDY OF RIVER WATER QUALITY FOR GREAT BRITAIN, Department of the Environment, Reading (England), Water Data Unit. For primary bibliographic entry see Field 7C. W87-00144

COST-EFFECTIVENESS OF THE U.S. GEO-LOGICAL SURVEY STREAM-GAUGING PRO-

M. E. Moss, W. O. Thomas, and A. G. Scott. Transportation Research Record 1017, p 8-15, 1985. 2 fig, 3 tab, 14 ref.

Descriptors: *Cost analysis, *Stream gages, *United States Geological Survey, Discharge simulation, Rivers, Standard deviation, Management

Results of the first year of a 5-yr study of cost-effectiveness of the U.S. Geological Survey stream gauging program are summarized. The first step of the study involved identification of data uses and iding sources for 1,939 continuous-record sta-

Field 7—RESOURCES DATA

Group 7A-Network Design

tions currently being operated, with a budget of \$11,425,630. Only 35 of these were identified as lacking sufficient justification for continued operation. In addition, 31 short-term, special study stations were identified as not having justified data uses beyond completion of their respective studies. In the second step, evaluation of alternative methods of providing streamflow information, flow-routing and regression models were developed for estimating daily flows at 143 stations of 1,939 stations analyzed. Only 6 of 145 stations that were analyzed were considered to have acceptable accuracy of the simulated flows for the intended uses of the data. Based on the accuracy of the simulated flows, the operation of continuous-record gauging stations at these locations could be discontinued. In the third step of the analysis, relationships were developed between the accuracy of the streamflow records and the operating budget. For the current operating budget, the weighted average standard error was 21.0% for the programs analyzed. By redistribution of resources among the stations seconding to an optimization program, this weighted average standard error could be reduced to 19.0%. The current weighted average standard error of 21.0% can, conversely, be achieved with a budget reduction of \$535,850. (Rochester-PTT)

HYDROLOGIC RESEARCH ON COASTAL PLAIN WATERSHED OF THE SOUTHEAST-

ERN UNITED STATES, J. M. Sheridan, and W. C. Mills. Transportation Research Record, No. 1017, p 16-23, 1985. 5 fig. 4 tab, 32 ref.

Descriptors: *Hydrologic research, *Coastal plain, *Watershed studies, *Little River Watershed, Southeast Watershed Research Laboratory, Agricultural Research Service, Rainfall, Streamflow, Alluvial groundwater, Flood peaks, Cypress Creek Procedure, *Southeast United States.

The Southeast Watershed Research Laboratory (SEWRL), of the Agricultural Research Service, U.S. Department of Agricultura, is conducting hydrologic research studies on watersheds of the Coastal Plain of the southeastern United States. The SEWRL has a 129-aq mi drainage area. The Little River Watershed (LRW), is divided into seven subwatersheds that are instrumented to obtain hydrologic data (rainfall, streamflow, and alluvial groundwater) for use in analyzing and evaluating Coastal Plain hydrologic processes. A description of the experimental study areas and the associated hydrologic instrumentation is presented. associated hydrologic instrumentation is presented. Basic hydrologic information is presented, as well as flood design information including instantaneous as flood design information is presented, as well as flood design information including instantaneous peak flow and maximum mean daily flow relation-ahips developed from the LRW hydrologic data. Ratios of instantaneous peak flows to maximum mean daily flows for selected return intervals for mean daily hows for selected return intervals for watersheds of 1 to over 100 sq mi are also present-ed. Also, an evaluation of the application of the Cypress Creek procedure (commonly used for ag-ricultural drainage design) on two LRW subwa-tersheds is presented. (Alexander-PTT) W87-00204

MONITORING NATURAL WATERS FOR DRINKING-WATER QUALITY, National Water Research Inst., Burlington (Ontar-For primary bibliographic entry see Field 5A. W87-00243

LABORATORY PERFORMANCE EVALUA-TION STUDIES AND THEIR RELATIONSHIP TO THE GLOBAL ENVIRONMENTAL MONI-TORING SYSTEM IN WATER (GEMS/

Environmental Monitoring and Support Lab.-Cincinnati, OH. Quality Assurance Branch. For primary bibliographic entry see Field 5A. W87-00244

FACTOR ANALYSIS OF THE MAP3S/RAINE PRECIPITATION CHEMISTRY NETWORK,

Governors State Univ., University Park, IL. Coll. of Arts and Sciences. For primary bibliographic entry see Field 2B. W87-00462

RANK CORRELATION FOR SCREENING PRECIPITATION CHEMISTRY DATA, Pennsylvania State Univ., University Park. School of Forest Resources.

D. R. DeWalle, and W. E. Sharpe.
Atmospheric Environment ATENBP, Vol. 20, No. 5, p 1031-1052, 1986. 2 tab, 2 ref.

Descriptors: *Chemistry of precipitation, *Error analysis, *Deposition, *Cations, *Anions, *Hydrogen ion concentration, Statistical analysis, Statistical methods.

Correlation between the concentrations of each Correlation between the concentrations of each measured ion and some measure of analysis error is proposed to find ions associated with errors in precipitation chemistry measurements. Rank correlation can be used to screen non-normally distributed precipitation chemistry data. Use of Spearman's rank correlation coefficient to screen precipitation chemistry data is illustrated for cation-anion balances of wet fallout samples from three widely dispersed measurement stations. (Author's abstrace) stract) W87-00465

SIGNIFICANCE OF SYSTEMATIC ERROR IN RAINFALL MEASUREMENT FOR ASSESSING WET DEPOSITION,

Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 5B. W87-00467

ANALYTICAL QUALITY CONTROL IN UNITED KINGDOM WATER INDUSTRY, WITH PARTICULAR REFERENCE TO HAR-

WITH PARTICULAR REFERENCE TO HAR-MONIZED MONITORING SCHEME FOR RIVER WATER QUALITY,
Anglian Water Authority, Huntingdon (England).
J. A. Tetlow, and D. T. E. Hunt.
Association of Official Analytical Chemists Journal JANCA, Vol. 69, No. 3, p 411-417, May/June 1986. 6 fig, 1 tab, 14 ref, append.

Descriptors: *Monitoring, *Water quality, *Quality control, *Water analysis, Chemical analysis, United Kingdom, Rivers.

The development of river water quality monitoring in the United Kingdom and the parallel development of analytical quality control (AQC) procedures within the UK water industry are described. Some results are presented for a sequential harmonized monitoring scheme of AQC which seeks to ensure comparability of analytical results obtained by different laboratories. The problems and advantages of such a scheme are examined, and future developments in nationally coordinated AQC in the water industry are discussed. After 10 years of the water industry are discussed. After 10 years of operation the required comparability of analytical results has been achieved for many determinands but not for a number of other important determination. ands. Definitions are proposed for accuracy, bias, precision, criterion of detection and limit of detec-tion. (McFarlane-PTT) W87-00491

WATER MONITORING NETWORKS IN COLD

CLIMATE AREAS, Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). D. Couillard.

Journal Environm Journal Environmental Systems, Vol. 15, No. 4, p 327-348, 1985-86. 2 fig. 2 tab, 110 ref.

Descriptors: *Water policy, *Water management *Monitoring networks, *Cold regions, Canada Monitoring, Finland, Sweden, Environments

Private, public, and para-public enterprises must evaluate the impacts of their projects on the qual-ity of the human environment, and seriously study possible alternatives. The use of methods for evalu-

ating environmental impacts is only possible through acquiring and understanding basic data on the initial environmental conditions that can be altered by a project. To further planning or monitoring efforts, numerous governmental and private organizations systematically generate basic environmental data. Following a brief review, methods for acquiring water quality data in use in Canada, Finland, and Sweden are analyzed. For each country, the groups resonsible for the data acquisition network are described by analyzing their objectives, techniques, efficiency, financial backing, personnel, and methods of data treatment. (Master-FIT) PTT) W87-00493

GEOSTATISTICAL ANALYSIS OF GEOELECTRIC ESTIMATES FOR SPECIFIC CAPACITY, Tiszadata Consulting Engineers, Budapest (Hunga-

ry).
For primary bibliographic entry see Field 2F.
W87-00635

BIOMONITORING NETWORKS OPERATED BY SCHOOLCHILDREN, International Joint Com

Canada, Windsor (Ontario).

T. Reynoldson, L. Hampel, and J. Martin.
Environmental Pollution (Series A) EPEBD7,
Vol. 41, No. 4, p 363-380, 1986. 3 fig. 5 tab, 7 ref.

Descriptors: *Monitoring, *Networks, *Network design, *Water quality, Benthic environment, Data acquisition.

The considerable logistical problems involved in large-scale monitoring networks could be overcome in part by establishing a biological water quality network of stations operated by high schools. Measurement of benthic invertebrate community structure obtained in a pilot project involving five schools produced results that were reliable with regard to collecting and identification efficiency. Early results from a network that includes more than 20 teachers and 500 students at 12 schools show an ability to identify changes in stream water quality. (Author's abstract) W87-00771

7B. Data Acquisition

LONG-TERM HYDROLOGIC MONITORING PROGRAM, AMCHITKA ISLAND, ALASKA. Department of Energy, Las Vegas, NV. Nevada Operations Office. For primary bibliographic entry see Field 7A. W87-00080

RECENT HYDROLOGICAL AND CLIMATO-LOGICAL ACTIVITIES IN THE AMAZON BASIN, BRAZIL, Projecto de Hidrologia e Climatologia da Ama-zonia, Belem (Brazil). For primary bibliographic entry see Field 2A. W87-00116

SLANTING HOLE RAINGAUGE PROPOSED FOR HILLSLOPE HYDROLOGY, National Chunghsing Univ., Taichung (Taiwan). Dept. of Soil and Water Conservation.
Y. -C. Chiang, and S. L. Liang.
IN: Hydrology of Humid Tropical Regions, IAHS Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 459-468, 11 fig, 1 tab, 11 ref.

Descriptors: *Slanting hole raingauge, *Hillslope hydrology, *Rain gages, Rainfall-runoff relation-ships, Typhoons, Tilted raingauge, Statistical anal-ysis, Hamilton's vector, Experimental design.

To investigate storm characteristics in typhoon areas, the correct location of the most suitable type of raingauge on a hillslope is the main method of improving the validity of hydrological projects in

Data Acquisition—Group 7B

watershed engineering. To account for variations due to topography, aspect, wind speed and other factors, experiments of latin square design, three randomized complete block experiments and other experiments were performed in Japan and Taiwan. From a statistical analysis of the data from experiments using four kinds of raingauge: tilted, slanting hole, Hamilton's vector, and conventional, the slanting hole raingauge is proposed as the most suitable for installation on hillslopes. Seven detailed experimental procedures showing how to compute the dimensions of the orifice, how to set up the gauge, and how to check the validity of its operation, are also given. Results from the experimental studies leads to the conclusion that the slanting hole raingauge is the most suitable for hillslope conditions. (See also W87-00086) (Lantz-PTT) PTT) W87-00125

HYDROGEN ISOTOPE STUDY OF LARGE-SCALE METEORIC WATER TRANSPORT IN NORTHERN CALIFORNIA AND NEVADA, California Univ., Davis. Dept. of Geology. For primary bibliographic entry see Field 2F. W87-00162

USING RADAR FOR GROUNDWATER INVES-TIGATION, Florida Univ., Gainesville. Dept. of Agricultural

Engineering. S. F. Shih, J. A. Doolittle, D. L. Myhre, and G.

W. Schellentrager.

Journal of Irrigation and Drainage Engineering
JIDEDH, Vol. 112, N. 2, p 110-118, May 1986. 2
tab, 3 fig, 10 ref.

Descriptors: *Radar, *Water table, *Groundwater, *Remote sensing, Florida, Massachusetts, Soils, Well data.

The feasibility of using ground-penetrating radar (GPR) in coarse-texture soils to determine depth to the water table was demonstrated in separate studies in Massachusetts and Florida. In Massachusetts, ies in Massachusetts and Florida. In Massachusetts, two sites were chosen to demonstrate the application of GPR techniques for water-table depth investigatin in a topographically diverse setting. In Florida, a site was selected to demonstrate the accuracy of measurements made from GPR profile and the water-table distribution over a study area. The difference between water-table depths from observation well data and radar profile was within 10 cm in all samples. The coefficient of determination between the well and the radar data was 0.90. The GPR with 120-MHz antenna was able to measure depth to the water table located at depths of up to 12 m in excessively drained, coarse-texture, upland soils, while with 300 MHz, the antenna was able to measure depth to the water table at depths of 1.7-2.4 m in poorly drained coarse-texture, coastal plain soils. (Alexander-PTT) W87-00196

USE OF A SURFACE GAMMA-NEUTRON GAUGE TO MEASURE EFFECTS OF TILLAGE, CROPPING, AND EROSION ON SOIL PROPERTIES,

Arizona Univ., Tucson. Dept. of Soils, Water and

Affizing Office, Tuesday, Dept. of Solis, Annual Engineering, L. R. Ahuja, R. D. Williams, G. C. Heathman, and J. W. Naney. Soil Science SOSCAK, Vol. 140, No. 4, p 278-286, October 1985. 2 fig. 4 tab, 9 ref.

Descriptors: *Gamma-neutron gages, *Tillage, *Cropping, *Erosion, *Soil, *Gamma rays, Soil bulk density, Soil properties, Soil water content.

Using a surface gamma-neutron gauge, soil bulk density and moisture content were measured at field capacity 1 to 100 and 0 to 300 mm deep at 40 locations in a tilled wheat field and 20 locations in an adjacent native pasture on a silt loam soil. Macroporosity at these sites was determined as total porosity minus field capacity. The bulk density of the 0- to 100-mm layer was lower than that of the 0- to 300-mm layer. The mean bulk density values were similar in both fields, but the field capacity was slightly higher, and the macroporo-

sity lower in the grass field than in the wheat field, especially for the 0- to 100-mm layer. Four methods of calculating the above soil properties from gamma readings were compared. Differences found among the four methods of calculation were small. The volumetric soil water content, 2 d after the soil had been wetted tid not vary much with depth within the topsoil (0 to 300 mm). Then, the surface neutron meter provided an acceptable value for the average bulk density calculated using that water content. The results demonstrate the tremendous utility of a surface gamma-neutron gauge for rapid hydrologic characterization of a variable field and for measuring the relative effects of tillage, cropping, and erosion depositions. (Main-PTI)

INSTRUMENT FOR MEASURING SMALL BOTTOM CURRENTS IN LAKES, U. Lemmin, M. Schurter, D. M. Imboden, Th. Joller, and H. Abegglen. Limnology and Oceanography LIOCAH, Vol. 30, No. 5, p 1116-1122, September 1985. 6 fig, 1 tab, 9

Descriptors: *Lakes, *Current meters, *Water currents, Instruments, Calibration, Switzerland.

rents, instruments, Caitoration, Switzeriand.

An instrument capable of recording bottom currents between 0.3 and 3 cm/s consists of an inverse pendulum with a slightly buoyant sphere and a light thread. At predetermined intervals a super-8 movie camera operating in single frame exposure records the position of the sphere with reference to a fixed point. Illumination is provided by an electronic flash. The sphere excursions are digitized by a computerized digitizing table upon which each frame is projected. Calibration in a tow tank yields a power law between excursion and current speed. Deviation from the theoretical curve demonstrates that the drag forces on the thread cannot be disregarded. Overall accuracy of the instrument is + or -5% for speed, + or -15 degrees for direction. The instrument has been successfully deployed in several Swiss lakes. (Author's abstract)

INTERESTING CLOUD FEATURES SEEN BY NOAA-6 3.7 MICROMETRE IMAGES, Oxford Univ. (England). Clarendon Lab. For primary bibliographic entry see Field 2B. W87-00398

TEMPORAL VARIATION OF RIVER WATER TEMPERATURES IN A DEVON RIVER

EXYSTEM, Exeter Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2E. W87-00403

UNUSUAL CANADIAN FLOODS AND THE CREAGER DIAGRAM, Northwest Hydraulic Consultants Ltd., Edmonton (Alberta).

For primary bibliographic entry see Field 2E. W87-00447

TVA'S USE OF COMPUTERS IN WATER RE-SOURCE MANAGEMENT, Tennessee Valley Authority, Knoxville. Div. of Air and Water Resources. For primary bibliographic entry see Field 6A. W87-00476

ANALYTICAL QUALITY CONTROL IN UNITED KINGDOM WATER INDUSTRY, WITH PARTICULAR REFERENCE TO HARMONIZED MONITORING SCHEME FOR RIVER WATER QUALITY, Anglian Water Authority, Huntingdon (England). For primary bibliographic entry see Field 7A. W87-00491

OPEN-CHANNEL FLOW MEASUREMENTS WITH A LASER DOPPLER ANEMOMETER,

Kyoto Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 2E. W87-00619

SLOPE-AREA DISCHARGE GAGING IN MOUNTAIN RIVERS,

Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 2E.

GEOSTATISTICAL ANALYSIS OF GEOELEC-TRIC ESTIMATES FOR SPECIFIC CAPACITY. Tiszadata Consulting Engineers, Budapest (Hunga-For primary bibliographic entry see Field 2F. W87-00635

SEPARATION OF A SNOWMELT HYDRO-GRAPH BY STREAM CONDUCTANCE, For primary bibliographic entry see Field 2E. W87-00639

STUDY OF DRINKING WATER QUALITY IN A COMMUNITY OF AMERICANS LIVING IN NAPLES, ITALY,

ental and Preventive Medicine Unit No. 7, New York. For primary bibliographic entry see Field 5F. W87-00680

WATER QUALITY MANAGEMENT FOR THE GREAT LAKES,

Wayne State Univ., Detroit, MI. Dept. of Civil neering. For primary bibliographic entry see Field 5G. W87-00739

HYDROLOGICAL AND HYDROGEOCHEMI-CAL METHODS FOR THE DELINEATION OF COMPLEX GROUNDWATER FLOW SYSTEMS EVIDENCED IN THE BET-SHEAN VALLEY, ISRAEL,

Ministry of Agriculture, Jerusalem (Israel). Hydrological Service. For primary bibliographic entry see Field 2F. W87-00781

SCANNING RECORDING SYSTEM FOR MUL-TIPLE CAPACITIVE WATER-DEPTH TRANS-DUCERS.

ERM-Southeast, Inc., Marietta, GA. H. R. Holbo, E. L. Miller, and R. C. Sidle. Journal of Hydrology JHYDA7, Vol. 79, No. 3/4, p 311-318, July 30, 1985. 4 fig, 5 ref. USDA Forest Service Cooperative Research Agreement PNW 80-254.

Descriptors: *Measuring instruments, *Electrical equipment, *Water depth, *Wells, *Alaska, *Groundwater levels, Rainfall, Stream discharge.

An electronic water-depth measuring and recording system has been developed, which scans transducers hourly with exceptional depth and time accuracy. Transducer design is simple and rugged. Cable lengths between transducers and recorder are not critical. The system, which has performed reliably for several storm seasons in coastal Alaska, reliably for several storm seasons in coastal Alaska, requires very little power and operates from a battery supply for extended periods. The system has been used to measure the response of ground-water to precipitation within a small catchment in the Kennel Creek drainage in Alaska. Water level decline following the storm varied from well to well, reflecting the localized differences in hydrau-lic conductivity and subsurface drainage. This design has proven cost-effective for continuous monitoring of well water levels and could easily be adapted for measuring rainfall and streamflow. (Author's abstract)

Field 8—ENGINEERING WORKS

Group 7C—Evaluation, Processing and Publication

7C. Evaluation, Processing and Publication

ESTIMATION OF AREAL PRECIPITATION, Kwara State Coll. of Technology, Ilorin (Nigeria). Kwara State Coll. of Technology, Ilorin (Nig Dept. of Survey. For primary bibliographic entry see Field 2B. W87-00114

HYDROLOGICAL COMPUTATION FOR WATER RESOURCES DEVELOPMENT WITHIN IMO RIVER BASIN, NIGERIA, Anambra State Univ. of Technology, Awka (Nige-

Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Civil Engineering.
S. C. Ojukwu.
IN: Hydrology of Humid Tropical Regions, IAHS
Publication No. 140, 1983. Proceedings of a Symposium Held at the 18th General Assembly of the International Union of Geodesy and Geophysics, Hamburg, West Germany, August 15-27, 1983. p 409-417, 3 fig. 3 tab, 5 ref.

Descriptors: *Water resources development, *Imo River, *Nigeria, *Hydrologic models, Economic aspects, Data interpretation, Rainfall intensity, Fre-quency distribution, Rainfall distribution, Model studies.

The economic and efficient planning of engineering systems requires relevant and reliable data. One area of hydrological concern and of importance for water resources development, for which data are lacking in West Africa, is in the design of drainage systems. To carry out this engineering work, rainfall intensity-duration-frequency distribution for the locality under consideration is desirable. The present work arose from the proposal of the Imo State Government in Nigeria to provide for the towns in the Imo River basin a suitable drainage network compatible with the agricultural for the towns in the Imo River basin a suitable drainage network compatible with the agricultural and forestry practice in its basin. An analysis of the rainfall data for the basin was carried out and from it a formula expressing the relationship between the rainfall intensity, the duration and frequency is proposed. The results will serve as a computational model useful in the design of dams and drainage systems within any tropical West African hydrological region with inadequate data. (See also W87-00086) (Author's abstract) W87-00120

COUNTRYWIDE STUDY OF RIVER WATER

COUNTRYWIDE STUDY OF RIVER WATER QUALITY FOR GREAT BRITAIN,
Department of the Environment, Reading (England). Water Data Unit.
C. Brown, J. C. Rodda, and M. Williams.
IN: Effects of Water Disposal on Groundwater and Surface Water, IAHS Publication No. 139, 1982. Proceedings of a Symposium held during the First Scientific General Assembly of the IAHS at Exeter, England, July 19-30, 1982. p 195-205, 5 fig. 14 ref.

Descriptors: *Rivers, *Water quality, *England, *Harmonized Monitoring Scheme, Data collections, Data interpretation, Networks, Monitoring, Water quality management.

During the last 10 years or so, a number of countries have been developing national river water quality data systems. The Harmonized Monitoring Scheme, the British system for the routine collection, archiving and publication of data on river water quality, commenced operation in 1974. Prior to that date, water quality monitoring had been undertaken largely on a local or river basin basis, with each responsible authority employing its own variant of the applicable methods of sampling and analysis. Consequently, the results obtained by one authority were not strictly comparable with those of the others. The establishment of the harmonized monitoring network was designed to overcome this problem and to: (a) enable estimates to be made in connection with the United Kingdom's international obligations, of materials carried down rivers into estuaries, (b) enable long term trends in water quality to be identified. The purpose of this study, however, is to present a summary of the large body of data collected so far in an easily

assimilated form. It is hoped that such a summary might prove useful for revealing spatial variations in water quality and for other purposes, such as establishing the basic lines from which future trends can be assessed. The mapping of these re-sults from the harmonized monitoring network provides a useful method of demonstrating spatial provides a useful method of demonstrating spatial variations in water quality. Obviously a lot more effort could have been devoted to investigating the reasons for the patterns exhibited and to mapping additional parameters. There are other questions raised in this paper, such as the appropriate treatment of the limit of detection values. These and other points will undoubtedly be the subjects of further study. (See also W87-00127) (Lantz-PTT) W87-00144

FLOOD SAMPLES FROM A THREE-PARAME-TER LOGNORMAL POPULATION WITH HISTORIC INFORMATION: THE ASYMPTOTIC STANDARD ERROR OF ESTIMATE OF THE

T-YEAR THOOD, Inland Waters Directorate, Ottawa (Ontario). For primary bibliographic entry see Field 2E. W87-00159

SPACE-TIME DISTRIBUTION OF SULFATE DEPOSITION IN THE NORTHEASTERN

UNITED STATES, Consolidation Coal Co., Pittsburgh, PA. For primary bibliographic entry see Field 5B. W87-00365

GLOBAL WATER VAPOR FLUX AND MAIN-TENANCE DURING FGGE,

Iowa State Univ., Ames. Dept. of Earth Sciences. For primary bibliographic entry see Field 2B. W87-00390

STRUCTURE OF A TYPHOON RAINSTORM IN THE MIDDLE LATITUDES OBSERVED BY

DOPPLER RADAR,
Meteorological Research Inst., Yatabe (Japan).
For primary bibliographic entry see Field 2B.
W87-00426

VARIANCE OF THE T-YEAR EVENT IN THE LOG PEARSON TYPE-3 DISTRIBUTION, Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). For primary bibliographic entry see Field 2E. W87-00641

DERIVATION OF THE PEARSON TYPE (PT)
III DISTRIBUTION BY USING THE PRINCIPLE OF MAXIMUM ENTROPY (POME),
Louisiana State Univ., Baton Rouge. Dept. of Civil

For primary bibliographic entry see Field 2E. W87-00671

CHOICE OF EXTREMAL MODELS BY AKAIKE'S INFORMATION CRITERION, Lisbon Univ. (Portugal).

Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 307-315, December 30, 1985. 3 tab, 15 ref.

Descriptors: *Extremal models, *Akaike's criterion, Gumbel models, Frenchet models, Weibull models, Random sampling, Parametric model, Statistics, Statistical models, Model studies, Flood

Given a random sample of maximum values such as oldest ages at death, yearly maximum floods, etc., it is of importance to identify a parametric model for such samples. Being the only asymptotic non-degenerate distributions for the normalized naxima for such samples, the three extremal models are the: Gumbel model, Frenchet model, Weibull model. These three extremal models can be put in a unified form called Generalized Extreme Value model (GEV). Note that for alpha > 0, alpha = 0, this model gives respectively the Frechet, Weibull and the Gumbel model.

Having restricted possible models to the GEV model, the statistical choice can then be formulated model, the statistical choice can then be formulated as a multiple test of hypotheses on the shape parameter alpha being grater, equal to or less than zero. However, it is often argued that other models often fit the data better than the above three asymptotes. Here it is proposed to use the identification method drived by Akaike (1973) as an alternative multiple hypothesis approach to overcome the above mentioned difficulty. This method has been used in other fields such as time series, etc., it has no optimality criteria. The simulation studies are restricted to the Gumbel, Frechet and Weibull models. Akaike's information criterion is proposed for the choice of extremal models and by simulation its effectiveness is analysed in choosing the tion its effectiveness is analysed in choosing the most likely among the Gumbel, Frenchet and Wei-bull models. (Khumbatta-PIT) W87-00672

APPROXIMATE METHOD FOR PUMPING TEST ANALYSIS IN NON-PENETRATING WELLS,

Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power. For primary bibliographic entry see Field 2F. W87-00674

COMPLETING MISSING GROUNDWATER OBSERVATIONS BY INTERPOLATION. Ministry of Agriculture, Jerusalem (Israel). Hydrological Service. For primary bibliographic entry see Field 2F. W87-00735

8. ENGINEERING WORKS

8A. Structures

CHANNEL TRANSFORM APPROACH FOR EXPLICIT COLEBROOK-WHITE SOLUTIONS FOR PARTIALLY FULL PIPES.

University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering. D. I. H. Barr.

Proceedings of the Institution of Civil Engineers, Part 2, Vol. 81, p 81-94, March 1986. 2 tab, 4 fig, 17 ref, 2 append.

Descriptors: *Pipes, *Channel flow, *Gradually varied flow, Colebrook-White function, Channel transform, Chezy assumption.

The sequence of calculations to obtain values of design variables in the case of partially full pipe flow is reviewed. It is assumed that the Colebrook-White function is adopted to determine the interrelations of variables, and that explicit working is desirable. To provide an explicit numerical method for the problem of determination of dept of flow, the concept of channel transform is introduced. Channel transform also provides alternative procedures for the already explicit problems of determination of discharge, gradient or size of pipe, where proportional depth is already stipulated. The necessary new forms or variants of the Colebrook-White function and its approximations are provided, and details are given of degree of accuracy achieved. The basis of the channel transform approach is that, in order to deal with the four problem situation arising in partially full pipe flow, an analogy should be sought with a four problem situation as provided by the bottom friction channel concept, rather than with the three problem situation of just-full pipe flow. There is considerable scope for the development of the approach so that allowance for true channel shape effects can be built into the procedure for specific applications. As more information becomes available, the channel transform approach provides a means of systematic inclusion for the actual discrepancy which occurs as between the application of the Chezy assumption and the real circumstances of there being true channel shape effects. (Alexander-PTT) The sequence of calculations to obtain valu PTT) W87-00191

Structures-Group 8A

ALGORITHM FOR THE DETERMINATION OF LIMITING GRADIENTS FOR PIPES FLOWING PARTIALLY FULL,

Ove Arup and Partners, London (England). D. Butler.

Proceedings of the Institution of Civil Engineers, Part 2, Vol. 81, p 125-131, March 1986. 3 figs, 6

Descriptors: *Pipes, *Gradually-varied flow, *Algorithms, Open channel flow, Hydraulic equations, Sewer designs, Colebrook-White equations.

An algorithm to calculate the limiting gradients for a series of pipes of increasing diameter, conveying liquid flowing under gravity was developed. The concept of theoretical minimum gradient was briefly discussed and it was explained how this is often modified in practice by limits on velocity and proportional depth of flow. A description was given of the way in which the algorithm deternines the minimum and maximum (limiting) gradients, thus defining the upper and lower bounds of the range of feasible gradients for each pipe size. The hydraulic equations governing flow in pipes running partially full are described and a correction factor to modify the Colebrook-White equation for open chanel flow is proposed. Programmable calculators are ideal for the calculations involved and allow individual experimentation with one calculators are ideal for the calculations involved and allow individual experimentation with the various hydraulic variables. An example is given of the application of this algorithm to a sewer design problem, using a programmable calculator. (Alexander-PTT) W87-00192

1983 SANTA CRUZ FLOOD: HOW SHOULD HIGHWAY ENGINEERS RESPOND, For primary bibliographic entry see Field 4C. W87-00202

GUATEMALA'S CHIXOY HYDROELECTRIC

SCHEME,
Motor-Columbus Ingenieurunternehmung A.G.,

Baden (Switzerland).
M. Gysel, and M. Lommatzsch.
International Water Power and Dam Construction,
Vol. 38, No. 6, p 15-18, June 1986. 8 fig.

Descriptors: *Guatemala, *Hydroelectric power, *Geological features, Headraces, Conduit systems, Powerhouses, Switchyards, Dam structures, Transmission lines.

Chixoy, the largest hydropower plant in Guatema-la, began commercial operation in April 1986. The plant adds 300 MW to the interconnected grid plant adds 300 MW to the interconnected griu system. Characteristics of the Chixoy project area, the headrace conduit system, the powerhouse and switchyard, the transmission line, and the access roads are discussed. Because of the extreme geo-logical difficulties along the 26 km-long headrace tunnel, construction was the most challenging task tunnel, construction was the most challenging task of the project. Extreme difficulties were also caused by the karstified limestone at the dam site, necessitating extensive foundation treatment and a large and deep grout curtain. These geological difficulties caused considerable construction delays and increased expenses. The independance from oil- or coal-fired generation this project provides will help the future development of the country's economy. (Main-PTT) W87-00315

PROPOSED MISICUNI MULTI-PURPOSE PROJECT IN BOLIVIA,
Project Misicuni Association, Cochabamba (Boliv-

ia).

J. Tavera, G. R. Romero, and J. M. Jordaan.

International Water Power and Dam Construction,
Vol. 38, No. 6, p 33-36, June 1986. 5 fig, 6 ref.

Descriptors: *Misicuni(Bolivia), *Planning, *Dams, *Design, Cost analysis, *Hydroelectric power, Hydraulic design.

The proposed Misicuni multi-purpose project in Bolivia is an example of how hydraulic and technical problems are being tackled in an economically depressed, mountainous country. All preliminary

and feasibility studies were positive. A market exists for both the power and agricultural prod-ucts. The article covers the planning, investigation and design phases up to the preparation of the final tender documents. (Alexander-PTT)

ELECTRICITY GENERATION PLANNING

FOR URUGUAY,
Power and Water Systems Consultants, Henleyon-Thames (England).
For primary bibliographic entry see Field 8C.
W87-00319

CONDITION OF THE CONCRETE DAM OF THE TOKTOGUL HYDROELECTRIC STATION ACCORDING TO ON-SITE OBSERVA-TION DATA,
For primary bibliographic entry see Field 8F.
W87-00451

EVALUATION OF THE CONDITION OF THE GRAVITY DAM OF THE KURPSAI HYDRO-ELECTRIC STATION DURING OPERATION, G. Y. Berdichevskii, Y. P. Kornev, and A. D.

Kryukov. Nyukov. Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 493-497, March 1986. 1 table, 8 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 35-38, September 1985.

Descriptors: *Gravity dams, *Dam construction, *Dam design, Design criteria, Hydroelectric plants, Structural behavior.

A table of allowable values for indices of the condition of the Kurpsai dam, USSR, corresponding to the normal (design) condition of the structure was compiled on the basis of generalizing the design decisions and analyzing the results of calculations exactly the conditions of the condition of the conditio design decisions and analyzing the results of calculations, experiments, and on-site observations during temporary operation. A comparison of the values measured on site with the allowable indices of the condition of the structure permits a prompt evaluation of the condition of the dam by checking the correspondence of the actual work of the structure to the design specifications. As the results of on-site observations are accumulated, the composition and values of the allowable indices of the condition of the dam can be corrected and supplemented, but under all conditions a check of the correspondence of the actual data to the design specifications should be a necessary element perspective of the condition of the condition of the structure. Calculation models provide such a check. (McFarlane-PTT) PTT) W87-00455

CHARACTERISTICS OF THE CALCULATION OF SURGE TANKS OF HYDROELECTRIC STATIONS. For primary bibliographic entry see Field 8B. W87-00456

PREDICTION OF ORGANIC CHEMICAL PER-MEATION OF ORGANIC CHEMICAL PER-MEATION THROUGH PVC PIPE, Goodrich (B.F.) Research and Development Center, Brecksville, OH. For primary bibliographic entry see Field 5B. W87-00505

IDENTIFYING WATER MAIN LEAKS WITH TRIHALOMETHANE TRACERS, Glenmore Waterworks Lab., Calgary (Alberta). E.E. Hargesheimer. American Water Works Association Journal JAWWAS, Vol. 77, No. 11, p 71-75, November 1985. 5 fig, 2 tab, 16 ref.

Descriptors: *Water distribution, *Leakage, *Tracers, *Drinking water, *Chloroform, *Water mains, Water conveyance, Pipelines, Gas chromatography, Alkalinity, Hardness, Conductivity, Hydrogen ion concentration, Seepage loss, Seepage control, Maintenance.

The trihalomethanes (THMs) chloroform and dichlorobromomethane, present in chlorinated

drinking water, were used as tracer compounds to identify the presence of treated city water in samples of seepage collected at leak sites in the distribution system. Using physical and chemical tests such as alkalinity, hardness, conductivity, and pH, the origin of leakage water samples often could not be identified unequivocally as treated city water, requarkater, or raw tiver water. Purposend-tran groundwater, or raw river water. Purge-and-trap gas chromatographic analysis detected nanogram-per-liter to low microgram-per-liter levels of chlo-roform and dichlorobromomethane and can be used to positively identify traces of treated city water. The method was successfully applied to the analysis of distribution system main and service line leak samples. (Author's abstract) W87-00506

MODEL INVESTIGATIONS OF SEISMIC ACTION ON THE CONCRETE ARCH DAM OF THE INGURI HYDROELECTRIC STATION, P. A. Gutidze.

Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 604-610, May 1986. 5 fig. 2 tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 26-30, November 1985.

Descriptors: *Dam stability, *Model studies, *Arch dams, *Concrete dams, *Seismic properties, Hydrostatic pressure, Hydroelectric plants, Models, Dam design, Vibrations, Mathematical models, Design criteria. nodels, Design crit

To substantiate the earthquake resistance of the concrete arch dam of the Inguri hydroelectric station, the Georgian Scientific-Research Institute of Power Engineering and Hydraulic Structures conducted studies on physical models corresponding both to particular problems of determining the seismic stress state of the dam for the design seismining the seismic stress state of the dam for the design seismining the seismic stress state of the dam for the design seismining the seisminin seasmic stress state of the dam for the design sen-micity - intensity 9 - and accelerations correspond-ing to the start of cracking in the dam from the seismic action and to problems of the effect of various design and operational characteristics of the dam on its seismic stability. Results showed that for real relations of the moduli of elasticity of that for real relations of the moduli of elasticity of the material (concrete) of the dam and foundation the deformation properties of the foundation sub-stantially affect the dynamic characteristics of the dam. The presence of joints leads to a decrease of the dynamic rigidity and increase of the decrement of natural vibrations of the dam. For the Inguri arch dam, the decrease of the natural frequency as a function of the tone is 5-10%. The change in the value of the decrement depends on the mode of natural vibrations of the dam and on the number of section joints. The models of natural vibrations of the dam practically do not change under the effect section joints. The models of natural vibrations of the dam practically do not change under the effect of the hydrostatic load, whereas the natural frequencies decrease. The presence of section joints to a considerable extent affects cracking in the dam, which is displayed mainly in a decrease of accelerations corresponding to the start of cracking. For the Inguri arch dam the presence of hydrostatic pressure increases the level of accelerations accompanying first cracks by an average of 20%. (Geiger-PTT)
W87-00536

UNIVERSAL GATE CHAMBER AS THE BASIS OF UNIFYING MECHANICAL EQUIPMENT OF BOTTOM OUTLETS, For primary bibliographic entry see Field 8C. W87-00538

INSTALLATION OF PIPELINES OF THE ZA-

INSTALLATION OF PIPELINES OF THE ZA-GORSK AND KAISHYADORYS PUMPED-STORAGE STATIONS, Y. M. Adlin, B. M. Dulin, and I. I. Kolpakov. Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 623-627, May 1986. 5 fig. 5 ref. Translat-ed from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 39-42, November 1985.

Descriptors: *Pipelines, *Pumped storage, Pumping plants, Pumpage, Pipes, Steel pipes.

Unique precast reinforced concrete-encased steel pipelines are presently being constructed at the Zagorsk and Kaishyadorys pumped-storage sta-

Field 8—ENGINEERING WORKS

Group 8A-Structures

tions. The pipelines will be moved by use of the traditional block-and-tackle methods of moving loads along horizontal and inclined planes by means of pulleys. For both stations, the route of the pipeline was divided into two installation stretches: upward and downward from the 'cross-cut,' through which elements of the pipeline are delivered for installation. Several variants of the pulley girders were tested at the Zagorak station and the improved variant of the installation equipment is being developed for the Kaishyadorys pumped-storage station. The resulting installation units are moved on four slides on tracks laid on the wall beams of the pipeline. Wood laminate is used as the antifriction material. Movement is carried out on greased rails. When improving the equipment, main attention should be focused on problems of safety of the installation works and a reduction of the labor intensity of the operation. (Geiger-PTT) (Geiger-PTT) W87-00539

PIPE NETWORK ANALYSIS BY PARTIAL PIVOTING METHOD, Karlsruhe Univ. (Germany, F.R.).
A. O. Demuren, and F. J. K. Ideriah. Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 5, p 327-334, May 1986. 7 fig. 2 tab, 14 ref.

Descriptors: *Pipes, *Networks, *Mathematical models, *Water distribution networks, Flow variables, Linear equations, Partial pivoting method.

A computer-oriented method of analyzing hydraulic networks is presented, in which the nonlinear energy equations are linearized to yield, together with the continuity equations, (A)(Q)=(C), ((A) = a discharge-coefficient matrix, (C) = a discharge-vector, (C) = a nodal-consumptive vector), that is solved by Gaussian elimination process refined with partial pivoting. The method is reliable and is shown to compare favorably with others. (Alexander-PTT) der-PTT) W87-00618

SELECTING TERMINAL WATER SURFACE

ELEVATIONS,
Army Engineer District, Sacramento, CA.
L. S. Dixon, and B. A. Sullivan.
Journal of Hydraulic Engineering (ASCE)
JHEND8, Vol. 112, No. 5, p 428-431, May 1986. i

Descriptors: *Water surface profiles, *Flood chan-nels, *Flood profiles, Flood control, Bed load, Design standards, Bays, Estuaries.

The design terminal water surface elevation was compared with the actual terminal water surface elevation of the flood flows on Corte Madera Creek, California January 4, 1982. The U. S. Corps of Engineers designed and constructed improvements which were bypassed in the flood. The design procedure has been based on the assumptions that an extreme high tide event would not cover at the same time as an extreme flood flow. occur at the same time as an extreme flood flow event; however, analysis of 524 observations of event; nowever, analysis of 524 Observations of peak flows and same-day higher high tides indicated that the tendency of high tides to occur the same day as flood flows is statistically significant. For future hydraulic design of flood control channels in San Francisco Bay, a design terminal water surface elevation will be selected with an expected frequency of recurrence equivalent to or greater than the frequency of the selected design flow. (Swanigan-PTT) w87-00624

COLLIFORD DAM SAND WASTE EMBANK-MENT AND ASPHALTIC CONCRETE MEM-BRANK

T. A. Johnston, and J. D. Evans. Institution of Civil Engineers Proceedings PCIEAT, Vol. 80, Part 1, p 769-784, June 1986. 14

Descriptors: *Colliford Dam, *Embankments, *As-phaltic concrete, *Structural engineering, Mem-branes, Dams, Reservoirs, Drainage water, Flow dishcharge.

The behavior of the Colliford Dam is described during impounding to the end of 1984. Reservoir filling has continued steadily, and the reservoir is now 70% full in terms of volume, with the water level within 3 m of the spillway crest. Instruments indicate that the dam has continued to behave as expected. The phreatic surface in the foundation is a meter or so below rockhead. The maximum movements noted to date have been 4 mm settlement and a 16 mm horizontal movement, both at dam crest. The membrane still appears to be virtually water-tight with scarcely measurable drips of water into the inspection gallery from the membrane drain. The total flow in the gallery has amounted to a maximum of 1 liter per second, most of this being contributed by the low-level drains. The drainage flow at the downstream toe has increased slightly as the reservoir level has risen, the maximum recorded flow to date being 1.3 Ml/ mcreased slightly as the reservoir level has risen, the maximum recorded flow to date being 1.3 MI/day. However, flows have continued to respond to rainfall to a greater extent than to reservoir level. (Doris-PTT) W87-00803

8B. Hydraulics

IMPACTS OF CHANNEL RECONSTRUCTION IN THE PILCHUCK RIVER, Washington Univ., Seattle. Dept. of Civil Engi-

For primary bibliographic entry see Field 6G. W87-00046

FLUVIAL GEOMORPHOLOGY AND DESIGN ENGINEERING APPLIED TO WATER-SUPPLY AND SMALL HYDROPOWER PROJECT IN WEST-CENTRAL NEVADA, Collins and Ryder, Reno, NV.
For primary bibliographic entry see Field 4B.
W87-00063

EFFECT OF FLOODPLAIN REGULATION ON

Federal Emergency Management Agency, Washington, DC. For primary bibliographic entry see Field 6F. W87-00084

DIFFUSION OF A THREE-DIMENSIONAL WALL JET IN A CONVEYANCE CHANNEL OF LIMITED WIDTH, Indian Inst. of Tech., Bomb B. S. Pani, and R. N. Dash.

Proceedings of the Institution of Civil Engineers, Part 2, Vol. 81, p 43-53, March 1986. 12 fig, 6 ref.

Descriptors: *Channels, *Flow rates, *Outlets, Jet diameter, Conveyance channel, Velocity decay, Bed shear, Flux.

The flow field of a three-dimensional wall jet emanating from a deeply submerged outlet is af-fected by the side walls of the conveyance channel. Initially, the jet diffuses in the same way as a three-dimensional wall jet. Depending on the relative width of the channel a transition zone occurs, downstream of which the characteristics of the jet downstream of which the characteristics of the jet are akin to those of a plane wall jet. The velocity decay and other mean characteristics of the jet were studied experimentally. In the case of three-dimensional wall jets diffusing into conveyance channels of limited widths, the side walls have a negligible effect on the behavior of the jet for width of the conveyance channel (W) exceeding 30 jet diameter (d). In the immediate vicinity of the outlet, the maximum velocity decays in a manner similar to that jof the classical three-dimensional wall jet. Beyond a certain distance from the outlet, the velocity decay is a kin to that of a plane jet. wall jet. Beyond a certain distance from the outlet, the velocity decay is akin to that of a plane jet. The transition distance increases with the relative width of the conveyance channel. For jets discharging into narrow channels, the longitudinal velocity defect is the lateral direction, very near the channel bottom, satisfies similarity in the case of a wide conveyance channel. The bed shear can be evaluated from the experimental curves. For identical discharge conditions at the outlet, narrow conveyance channels experience larger bed shear.

For a channel having W/d as small as 15, the forward momentum flux of the flow was observed to be very nearly preserved. (Alexander-PTT) W87-00190

CHANNEL TRANSFORM APPROACH FOR EXPLICIT COLEBROOK WHITE SOLUTIONS FOR PARTIALLY FULL PIPES, University of Stratchyde, Glasgow (Scotland). Dept. of Civil Engineering. For primary bibliographic entry see Field 8A. W87-00191

ALGORITHM FOR THE DETERMINATION OF LIMITING GRADIENTS FOR PIPES FLOWING PARTIALLY FULL, Ove Arup and Partners, London (England). For primary bibliographic entry see Field 8A. W87-00192

LATERAL WEIRS IN TRAPEZOIDAL CHAN-

Concordia Univ., Sir George Williams Campus, Montreal (Quebec). Dept. of Civil Engineering. A. S. Ramamurthy, U. S. Tim, and L. B. Carballada.

Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 12, No. 2, p 130-137, May 1986. 1 tab, 4 fig, 11 ref.

Descriptors: *Channels, *Weirs, *Hydrodynamics, Jet velocity, Discharge coefficient.

The theory of lateral flow through a two-dimensional channel outlet is used to derive an expression for the outflow through a trapezoidal lateral weir discharging from a trapezoidal channel. The analysis is an extension of the existing hydrodynamic model for lateral flow through a rectangular minipass is an extension of the existing hydrodynamic model for lateral flow through a rectangular weir located in the side of a rectangular channel. The weir discharge coefficient is expressed as a function of a parameter relating the geometry of the weir and the channel and a parameter denoting the ratio of the mean velocity of the channel to the resultant jet velocity of the weir flow. Experimental results are provided to validate the proposed expressions for the weir discharge coefficient. Based on a simplified mode, an expression for the variation of the mean discharge coefficient with the weir velocity parameter for various values of outlet width or weir width at free surface level to width of channel and width of free surface in open channel is obtained for trapezoidal lateral weirs discharging from trapezoidal channels. The experimental data appear to validate the proposed expression. (Alexander-PTT)

CULVERT SLOPE AND SHAPE EFFECTS ON OUTLET SCOUR.

S. R. Abt, C. A. Donnell, J. F. Ruff, and F. K.

Transportation Research Record, No. 1017, p 24-30, 1985. 13 fig, 5 tab, 8 ref.

Descriptors: *Culverts, *Slope, *Outlets, *Scour, Hydraulic gradient, Correlation, Design, Flume

A flume study was conducted to evaluate the effect of culvert shape and slope on outlet scour after 316 min of testing. A circular culvert was tested at 0, 2, and 5% slopes. The soour hole characteristics of depth, width, length, and volume were correlated to the discharge intensity (Q sub g to the (6.5) power D to the (2.5) power for each slope. An increase in slope subsequently increased the dimensions of scour. The culvert slope significantly affected the scour volume estimates based on prediction equations currently in practice. Tests of circular, square, arch, and rectangular culverts were made with full flow for 316 min. The maximum depth, width, length, and volume of scour were made with full flow for 516 min. The maximum depth, width, length, and volume of scour were correlated to a modified discharge intensity (QA sub g to the (0.5) power D to the (0.5) power) for each culvert shape. Relationships were derived for predicting outlet scour for each culvert shape. Composite representations were compiled

Hydraulics—Group 8B

that correlate the dimensions of scour to the modified discharge intensity independent of culvert shape. The results indicate that culvert shape has a limited effect on outlet scour. (Author's abstract) W87_00205

TEMPORAL AND SPATIAL VARIATION OF SNOW PRESSURE ON STRUCTURES, Norges Gootkniske Inst., Oslo. For primary bibliographic entry see Field 2C.

FLOW AND BED DEVIATION ANGLE IN CURVED OPEN CHANNELS, Hydraulics Research Station, Wad Medani (Sudan). For primary bibliographic entry see Field 2E.

W87-00325

VORTEX-EXCITED VIBRATIONS OF UNDER-FLOW GATES.

Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik

N. D. Thang, and E. Naudascher. Journal of Hydraulic Research, Vol. 24, No. 2, p 133-151, 1986. 10 fig, 1 tab, 34 ref.

Descriptors: *Flow, *Underflow, *Vibrations, *Vortices, Eddies, Underflow gates.

The dynamic forces and oscillations of vertical-lift In a dynamic forces and osculations of vertical-int rectangular gates submerged in free-surface flows were investigated. In the range of low reduced velocities (V sub r < 5). The oscillations were excited by the vortices due to the dynamic interaction between the elastic gate and the unstable shear layer underneath the gate. Spectral analysis of the excitations force and cate exprose signals permit. excitations-force and gate-response signals permit-ted identification of the main characteristics of the ten incentineation of the main characteristics of the interaction process. The main similitude parameters governing this hydroelastic phenomenon are the reduced velocity and the mass-damping coefficient. The study permits a number of general conclusions to be drawn regarding model tests on vibrating structures. (Author's abstract) W87-00327

HYDRAULIC CALCULATION OF THE SPILL-WAY STRUCTURE OF THE GETIK RESER-VOIR ON THE CHICHKHAN RIVER,

O. V. Tokmadzh G. Adilkhanyan. nadzhyan, E. A. Khachatryan, and A

Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 484-488, March 1986. 3 fig. 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 29-32, September 1985.

Descriptors: *Hydraulic engineering, *Spillwa*Getik Reservoir, *Chichkhan River, Dams, menia, Mathematical equations, Mathematical at vais. Flow profile.

For one-dimensional hydraulic calculations of spillway structures the differential equation of non-uniform flow, with variable parameters over the length of its particular cases, can be taken as the base. The boundary conditions of the differential equations of nonuniform flow are determined either by the method of singular points with a physical analysis of the flow, or on the basis of the hydraulic conditions before and after the stretch being considered. A method of calculating spillway structures with high accuracy is described which makes it possible to do away with laborious and approximate methods, use of tables and nomograms, and making gross assumptions. (McFarlane-PtT) W87-00453

CHARACTERISTICS OF THE CALCULATION OF SURGE TANKS OF HYDROELECTRIC STATIONS,

S. V. Zakach

S. V. Zasachum Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 498-503, March 1986. 4 fig, 6 ref. Translat-ed from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 39-42, September 1985.

Descriptors: *Hydraulic engineering, *Hydroelectric plants, Surge tanks, Pressure conduits, Hydraulic loss, Velocity head.

Upstream surge tanks are usually constructed at hydroelectric stations with long diversion pressure circuits. Calculation principles for determining fluctuations in systems with surge tanks have remained unchanged for many years. During an unsteady process, where the level in the surge tank changes, head losses in a branch can include a variable component of the velocity head; the structure of the losses in the transition at a fork changes as a function of the direction and relation of the water discharges in the branches. The presently used form of taking into account losses in a transition and velocity head correspond only to the initial conditions of the transient. It is recommended that losses be determined on the basis of experied that losses be determined on the basis of experi-mental data with consideration of the actual ratio mental data with consideration of the actual ratio of discharges in the diversion conduit and surge tank. Consideration of hydraulic losses in the tran-sition leads to a greater range of fluctuations of the level. Refinement is especially important for small-er lengths of the pressure conduits and smaller values of the additional coefficient of the surge

CALCULATION OF NONCIRCULAR TUNNEL LININGS FOR INTERNAL PRESSURE AND UNIFORM GROUNDWATER PRESSURE,

No. 11, p 601-604, May 1986. 1 fig. 1 tab, 3 ref. Translated from Girlortekhnicheskoe Stroitel'stvo No. 11, p 24-26, November 1985.

Descriptors: *Tunnels, *Tunnel linings, *Hydraulic design, *Mathematical studies, *Tunnel hydraulics, Rock mechanics, Pressure distribution.

nes, Rock mechanics, Pressure distribution.

A method of calculating closed monolithic linings of arbitrary cross section for internal pressure and groundwater pressure is proposed on the basis of using methods of the theory of analytic functions of a complex variable. It is assumed when calculating the internal pressure that the depth of the tunnel is greater than five times the radius of the smallest circle encircling the tunnel. The usual conditions of smoothness are imposed on the contours of the lining cross section. The present method was checked by comparing the results of calculating the lining of a noncircular tunnel with the stresses and forces obtained by N.N. Fortieva for the same lining. The two solutions practically coincided. The error for stresses using the present method can also be used when solving the quasistatic problem of calculating a lining for a seismic load. (Geiger-PTT)

W87-00535

RECTANGULAR LATERAL ORIFICES IN

OPEN CHANNELS,
Concordia Univ., Sir George Williams Campus,
Montreal (Quebec). Dept. of Civil Engineering.
A. S. Ramamurthy, U. S. Tim, and S. Sarraf.
Journal of Environmental Engineering (ASCE)
JOEEDU, Vol. 112, No. 2, p 292-300, April 1986. 5 fig, 12 ref.

Descriptors: *Channels, *Channel flow, *Orifices, Mean discharge coefficient.

The theory of lateral flow through a two-dimensional channel outlet is used to derive an expression for the flow through a rectangular lateral orifice discharging from a rectangular lateral orifice discharge coefficient is expressed as a function of a parameter relating the length of the orifice and the width of the main channel and a parameter denoting the ratio of the mean velocity in the main channel to the resultant velocity of the jet through the orifice. The mean orifice discharge coefficient is a function of the geometric parameter L/B which denotes the ratio of the length of the orifice to the width of the main channel and a velocity parameter which denotes the velocity ratio at the sill height of the orifice. Experimental data provide verification of the proposed expressions for the mean discharge coefficient of the

orifice when a reduction factor of 0.95 is applied to account for the velocity distribution of the flow in the main channel. It is concluded that the proposed expression for mean discharge coefficient for lateral orifice is applicable to lateral orifices that can be as wide as the main channel. (Peters-PTT) W87-00594

PREDICTION AND CONTROL OF DOWN-PULL ON TUNNEL GATES,

Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hy-

E. Naudascher, P. V. Rao, A. Richter, P. Vargas, and G. Wonik

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 5, p 392-416, May 1986. 21 fig, 1 tab, 10 ref.

Descriptors: *Tunnels, *Gates, *Flow rates, Flow discharge, Tunnel hydraulics, Dimensional analysis, Hydraulic geometry, Overflow.

A one-dimensional analysis of the discharge passing under a tunnel gate and the hydraulic downpull acting on it is presented. Downpull is significantly affected by the geometry of the gate bottom and by the rate of flow passing over the top of the gate through the gate well. Downpull on a tunnel gate can be significantly reduced by appropriately controlling this overflow. The analysis includes the dangerous range of extremely large gate openings and the unsteady effect of gate movement. The significant flow and downpull parameters are given from systematic water tunnel experiments. (Swanigan-PTT)

SEGMENTAL HYDRAULIC SIMILARITY IN ONE-DIMENSIONAL RETARDING FLOW, For primary bibliographic entry see Field 2J. W87-00623

FLOW IN CURVED CONVERGING CHANNEL, Ministry of Physical Planning, Housing and Envi-ronment, Athens (Greece).

A. Damaskinidou-Georgiadou, and K. V. H.

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 6, p 476-496, June 1986. 14 fig, 1 tab, 35 ref.

Descriptors: *Open-channel flow, *Intercepting channels, *Channel flow, Finite difference methods, Velocity, Water surface profiles, Vortices, Diversion, Banks.

An experimental and numerical investigation was carried out into flow in a curved converging channel as a part of a study related to curved channel sediment excluders. The finite difference computational model gave values that were in good agreement with experimental results. For the channel geometry the calculated and observed values of mean longitudinal velocity approximated a free vortex along the channel. The investigation demonstrated it is possible to calculate the main parameters required for the design of a curved channel sediment excluder. The curved converging channel can be used successfully as a sediment excluder because the secondary flow, which develops upstream from the deviation, is strong enough to move any particles traveling along the bed toward the inside wall and away from the canal entrance. (Swanigan-PTT) W87-00627

EFFECT OF SEDIMENT ON EARTHQUAKE-INDUCED RESERVOIR HYDRODYNAMIC RESPONSE,

Delaware Univ., Newark. Dept. of Civil Engineer-

A. H. D. Cheng. Journal of Engineering Mechanics (ASCE) JENMDT, Vol. 112, No. 7, p 654-665, July 1986. 4 fig. 7 ref. NSF Grant CEE-8307090.

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

Descriptors: *Reservoirs, *Hydrodynamics, *Earthquakes, Sediments, Lakes, Mathematical studies, Model studies.

In a typical reservoir a sediment layer of considerable depth may be deposited on top of exposed bedrock foundation. The effect of sediment on the dissipation and damping of earthquake induced hydrodynamic waves is by and large ignored in earlier studies of dam-reservoir-foundation systems. The present work models the sediment as a porcelastic material. For vertical excitations, analytical solutions are sought with the aid of computing and the sediment of the sediment of the sediment of the sediment of the sediment as a porcelastic material. For vertical excitations, and the sediment of the sediment porcelastic material. For vertical excitations, analytical solutions are sought with the aid of computer algebra (MACSYMA). Based on a simplified, one-dimensional analysis, the following conclusions are drawn: (1) For the case of saturated pore water, the interaction between the sediment and the reservoir is negligible. The damping is mainly contributed by the elastic foundation; (2) When the pore water is slightly desaturated, even a thin sediment layer can significantly modify the reservoir response curves. As none water compressibilpore water is slightly desaturated, even a thin sediment layer can significantly modify the reservoir response curves. As pore water compressibility increases, the resonances take place carlier and the peaks are higher; and (3) Appreciable damping of hydrodynamic force may be observed around the resonance peaks for sediments that are highly permeable, partially saturated, and stiff. For problems with more complicated geometry and/or non-vertical earthquakes, the following is recommended: (1) Due to the significance of sediment layer on reservoir hydrodynamic response, in a more elaborate three-dimensional dam-reservoir-foundation analysis, it may be necessary to explicitly model rate three-dimensional dam-reservoir-tounation analysis, it may be necessary to explicitly model the sediment geometry to uncover an additional effect; and (2) In simpler models which utilize bottom damping coefficients, an equation has been devised which approximates the sediment and foundation damping effect. (Author's abstract)

EXPLICIT PIPE NETWORK CALIBRATION, Kentucky Univ., Lexington. Dept. of Civil Engi-

neering. L. E. Ormsbee, and D. J. Wood. Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 2, p 166-182, April 1986. 1 fig, 5 tab, 9 ref.

Descriptors: *Networks, *Pipes, *Calibration, Hydraulics, *Headloss coefficients, Equations, Mathematical studies, Model studies, Mathematical equations, Flow, Algorithms.

In order to improve the reliability of hydraulic network models as well as eliminate the need for trial-and-error calibration methods, an explicit calitrial-and-error calibration methods, an explicit cali-bration algorithm is proposed. The calibration al-gorithm is formulated in terms of headloss coeffi-cients and is developed from a reformulation of the basic network equations. The basic network equa-tions are solved explicitly for headloss adjustments to exactly meet one or more measured conditions of pressure of flow for given network loading and operating conditions. The adjustments determined in this manner are used to revise pipe roughnesses or defined concentrations. in this manner are used to revise pipe roughnesses or defined concentrated head (minor) losses to or defined concentrated nead (minor) losses to meet the measured conditions. In order to demonstrate the feasibility of the approach, the developed algorithm is applied to an example network. (Author's abstract) W87-00746

CASE STUDY: PIPE NETWORK MODEL CALI-

BRATION ISSUES, Army Engineer Waterways Experiment Station, Vicksburg, MS. For primary bibliographic entry see Field 5F. W87-00751

RECTANGULAR CYLINDERS IN FLOWS WITH HARMONIC PERTURBATIONS, David W. Taylor Naval Ship Research and Development Center, Betheada, MD. C. Knisely, M. Matsumoto, and F. Menacher. Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 8, p 690-704, August 1986.

Descriptors: *Harmonic perturbations, *Rectangular cylinders, *Hydrodynamics, *Wakes, *Vorti-

ces, Steady flow, Shear, Pressure, Shedding fre-

quency.

The effects of small-amplitude harmonic perturbations on the pressure coefficients and wake development behind rectangular cylinders were examined. Two body configurations with streamwise body dimension/transverse body dimension (B/D) = 0.5 and 2.0 were used. For the B/D = 0.5 body, with the pulsation frequency equal to twice or four times the natural shedding frequency, and with amplitudes of the order of 1% of the freestream velocity, the mean base pressure showed a decrease of up to 18% when compared with its value in steady flow. Flow visualization shows this decrease in mean base pressure to be associated with increased vortex strength, decreased with increased wortex strength, decreased with increase in shear layer curvature. When the perturbation amplitude exceeded an undetermined threshold value at a frequency corresponding to four times the plitude exceeded an undetermined threshold value at a frequency corresponding to four times the natural shedding frequency, two vortices were shed simultaneously and symmetrically with re-spect to the body centerline. For the B/D = 2.0 body, the primary effect of the pulsations is to enhance the orderly structure of the separated shear layers. (Author's abstract) W87-00825

SYSTEM DYNAMICS APPROACH TO PIPE

NETWORK ANALYSIS,
Tokyo Univ. of Agriculture and Technology
(Japan). Dept. of Agricultural Engineering.
K. Onizuka.

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 8, p 728-749, August 1986. 7 fig, 2 tab, 25 ref.

Descriptors: *Pipelines, *Network design, *Rigid water column theory, *Differential equations, *Liapunov function, Runge-Kutta method, Time integration, Mathematical analysis, Flow profile,

A method of analysis based on rigid water column theory for slow transients and steady-state flows in pipe networks is described. A graph theoretic formulation yields a system of ordinary differential equations of the first order that describe the dynamic behavior of the network. A definite Liapunov function of quadratic form to prove asymptotical stability of the network at the steady state is derived from Tellegen's Theorem in electrical circuit theory; this steady state function gives a unique and precise criterion for the attainment of the state by the system. The time integration can be performed directly by using, for example, the Runge-Kutta method without involving any iterative procedure. Simulations of slow transients and tive procedure. Simulations of slow transients and dynamic relaxation processes to solve the steady-state flow problem are shown in terms of small networks. (Author's abstract)

CORIOLIS GENERATED SECONDARY CUR-

RENTS IN CHANNELS, Luleaa Univ. (Sweden). Div. of Water Resources Engineering. R. Larsson.

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 8, p 750-767, August 1986. 13 fig, 1 tab, 23 ref.

Descriptors: *Coriolis force, *Channel flow, *Secondary currents, *Flow velocity, Numerical models, Simulation, Turbulent flow, Depth, Chan-Numerical nels. Rossby number.

The effects of rotation on turbulent channel flow are discussed, particularly the influence of the earth's rotation is analyzed and some of previous literature is reviewed. It is shown that Coriolisinduced secondary currents should be of importance if they have a magnitude of 1% of the downstream velocity. A simplified analysis is used to estimate the relative magnitude of the horizontal secondary velocity at the cross-plane center point for fully-developed flow in a wide channel as a function of Rossby number. Numerical model simulations are used to investigate the influence of the side walls and the magnitude of the secondary

velocities for developing flow. The results show that the secondary velocities amount to about 1% of the downstream velocity for rather slowly flow-ing deep channels. (Author's abstract)

DISPERSION TENSOR IN ROTATING

FILOWS, Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering. V. Alavian. Journal of Hydraulic Engineering JHEND8, Vol. 112, No. 8, p 771-777, August 1986. 3 fig, 12 ref.

Descriptors: *Mapping, *Rotating flow, *Dispersion tensor, Cartesian coordinates, Shear, Hydrodynamics, Hydraulic models, Longitudinal diffusion coefficients, Fluid mechanics, Mass.

A simple formulation is presented to map dispersion of mass in a two-dimensional rotating flow onto a second-order dispersion tensor in a Cartesian frame of reference. Simulation results are discussed for transport of mass in a fluid rotating as a solid body and a shear-induced flow in a square cavity. The results indicate that the time-varying shape of a tracer cloud being transported by a rotating flow, can be modeled using the longitudinal diffusion coefficients and equations, for the second-order diffusion tensor for each of the Cartesian coordinates xx, yy, and xy. The PTT) W87-00830

8C. Hydraulic Machinery

SEDIMENT CONTROL THROUGH DREDG-

Corps of Engineers, Atlanta, GA. A. W. Mohr.

IN: Estuarine Comparisons, 1982. Proceedings of the Sixth Biennial International Estuarine Research Conference, Gleneden Beach, Oregon, November 1-6, 1981. p 635-646, 8 fig. 1 tab, 4 ref.

Descriptors: *Sediment control, *Dredging, *Sedimentation, Cost-benefit analysis, Hydraulic dredges, Mechanical dredges, Environmental effects, Spoil disposal, Navigable waters.

Sediment control is necessary, but its traditional benefit-cost comparison is no longer the sole criterion for its use. Control can be achieved in various forms of river training and dredging. Dredges are divided into hydraulic and mechanical dredges, their dominant types being the cutterhead, hopper, and endless chain bucket dredges. The operating principle of hydraulic dredges is more copmlex than that of mechanical dredges and is subject to several constraints. Yet, nearly all dredging in this country is hydraulic, with a more even distribution among the other types in the rest of the world. country is hydraulic, with a more even distribution among the other types in the rest of the world. Dredged material density increases in importance due to increases in transport distances, environmental concerns, and fuel consumption. It also edifects some sediment measurements which can be obtained in place or while the material is handled. Upon comparing dredging to river training, neither method is universally advantageous. Both methods will continue to crist side-by-side and be decided upon a case-by-case basis. (See also W87-00005) (Author's abstract)

GUATEMALA'S CHIXOY HYDROELECTRIC

Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland). For primary bibliographic entry see Field 8A. W87-00315

HYDROPOWER IN URUGUAY, Universidad de la Republica, Montevideo (Uru-

ENGINEERING WORKS-Field 8

Hydraulic Machinery—Group 8C

guay). Hydraulic Inst. A. R. Fontal. International Water Power and Dam Construction, Vol. 38, No. 6, p 27-28, June 1986. 4 tab.

Descriptors: *Hydroelectric power, *Uruguay, *Dams, Hydroelectric potential.

Before 1946 all power generation in Uruguay was thermal, and the country was dependent on imported oil or coal for power. The construction of the Rincon del Bonete hydroelectric plant began before the Second World War, but was not put into operation until 1945. Recent studies indicate that the usable potential of the country could reach 1225.8 GWh/year. To obtain this energy it will be necessary to build nine new power plants and dams. Seventy-six per cent of the overall theoretical hydroelectric potential of the country is at present being exploited. (Main-PTT)

ELECTRICITY GENERATION PLANNING FOR URUGUAY, Power and Water Systems Consultants, Henley-

on-Thames (England) T. Wyatt.

International Water Power and Dam Construction, Vol. 38, No. 6, p 36-42, June 1986. 4 fig, 3 tab, 2

Descriptors: *Electricity, *Uruguay, *Planning, Computer programs, Model studies, Forecasting, Operating costs, Hydroelectric power.

In 1980 a study was undertaken to plan expansion of the electricity generation system in Uruguay. The study included identifying schemes for exploiting remaining hydropower potential. This paper outlines the central activities of the study and the results obtained. Emphasis was placed on the account taken of reservoir release policy when estimating future system operating costs and supply reliability. (Main-PTT)

VORTEX-EXCITED VIBRATIONS OF UNDER-FLOW GATES

Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hy-For primary bibliographic entry see Field 8B. W87-00327 dromechanik.

MULTIPARAMETRIC SENSITIVITY ANALY-SIS OF ENERGY PRODUCTION PROJECTS, C I Power Services Ltd., Toronto (Ontario). For primary bibliographic entry see Field 6A. W87-00439

GRAVITY FLOW-SIPHON SYSTEM OF COOL-ING COMPONENTS OF TURBINE-GENERA-TOR UNITS, V. N. Khovko, and L. G. Rubinson. Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 466-468, March 1986. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 14-15, Sentember 1985 2 für. September 1985. 2 fig.

Descriptors: *Cooling, *Gravity flow, *Turbines, *Siphons, Electrical equipment, Hydroelectric plants, Cost analysis.

Introduction of gravity flow-siphon cooling systems in place of a forced system allowed six pumps, each with a capacity of 800 cm /hr and 95 kilowatt electric motors, to be put into reserve. This annually saved 4 million kilowatt hours of electricity and considerably reduced labor and material expenditures for maintaining the pumping station. The gravity flow-siphon system has provided effective cooling for 20 years. (McFarlane-PTT) PTT) W87-00450

CHARACTERISTICS OF LOSSES INCURRED FROM RESTRICTION OF WATER USE AND ELECTRIC POWER CONSUMPTION, For primary bibliographic entry see Field 6D.

DYNAMIC PROGRAMMING IN HYDROPOW-

ER SCHEDULING, Acres International Ltd., Niagara Falls, NY. For primary bibliographic entry see Field 6A. W87-00471

W87-00452

WINDY GAP PROJECT SCADA SYSTEM, Northern Colorado Water Conservancy District, Loveland. For primary bibliographic entry see Field 6A. W87-00473

MECHANICAL EQUIPMENT OF THE CHAM-BER OF THE BULKHEAD GATES OF THE DIVERSION TUNNELS OF THE ROGUN HY-

DROELECTRIC STATION,
B. V. Bogomolov, and V. V. Bushuev.
Hydrotechnical Construction HYCOAR, Vol. 19,
No. 10, p 552-555, April 1986. 3 fig. Translated
form Gidrotekhnicheskoe Stroitel'stvo, No. 10, p
42-44, October 1985.

Descriptors: *Bulkhead gates, *Bulkheads, *Hydroelectric plants, *Gates, *Hydraulic machinery, Mechanical equipment, Diversion structures, Tunnels, Hydraulic equipment.

nels, Hydraulic equipment.

A new valve-type additional gate was installed at the diversion tunnels of the Rogun Hydroelectric Station. The new gate practically precludes the possibility of wedging during operation while the possibility of wedging during operation while the presence of a counterweight permits eliminating any special mechanism for closing the additional gate. The presence of a rod on the counterweight with the valve allows opening the counterweight with the valve allows opening the valve by the crane of the gate chamber room and rigidly fixing the open position of the valve on the hermetic cover. The dimensions of the shaft of the counterweight permit removing the additional gate to the room of the mechanism for inspection or maintenance. Short-stroke hydraulic drives with a capacity of 700 tons were developed for operating the bulkhead gates. The rods connecting the hydraulic drives with the gates were made detachable. With a total working length of the rod of 17.6 m it was possible to divide it into sections not more than 6.3 m long, which, as the gate is lifted, are disconnected and removed to a special rod storage. This made it possible to reduce the volume of rock excavation by 550 cu m due to a reduction of the height of the room of the mechanisms of the bulkhead gate chamber. (Geiger-PTT) head gate chamber. (Geiger-PTT) W87-00528

TOOTHING-FREE METHOD OF INSTALLING THE EMBEDDED PARTS OF GATES AT THE CHEBOKSARY HYDROELECTRIC STATION,

CHEBURSARY HYDRUELECTRIC STATION, L. F. Varlamova. Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 556-559, April 1986. 3 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 45-48, October 1986.

Descriptors: *Hydroelectric plants, *Hydraulic equipment, *Construction equipment, Hydraulic machinery, Gates, Design criteria.

During construction of the Cheboksary hydrostation, all embedded parts of the grooves of the gates and racks of the powerhouse were installed as preliminarily enlarged, concrete-encased groove blocks (CEGB) by the toothing-free method. The labor intensity of the manufacture and installation of the CEGB was manufacture 3.34 man-days; installation 3.82 man-days; total 7.16 man-days. The consumption of materials of the concrete-encased open-groove blocks was 480 kg, including 275 kg of metal. The toothing-free method of installing groove structures makes it possible to organize better technological methods of construction and installation works with a high level of mechanization of labor-intensive processes, to perform works on straightening, finishing, and fastening of the embedded parts in the block at the casting yard, to reduce the amount of work and number of installers working directly at the hy-

drostation, to reduce the load of the cranes on installation works, and to accelerate construction of the dam and start-up of the first units with considerably smaller volumes of works in the toothed sections of the powerhouse. (Geiger-PTT)

INSTALLATION OF SPECIAL GANTRY CRANES BY MEANS OF JIGS AT HYDRO-ELECTRIC STATIONS UNDER CONSTRUC-TION.

M. S. Kuptsova. Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 560-563, April 1986. 3 fig. Translated from Gidrotekhnichesko Stroitel'stvo, No. 10, p 48-50, October 1985.

Descriptors: "Hydroelectric plants, "Hydraulic equipment, "Hydraulic machinery, Powerplants, Gates, Construction equipment.

When constructing low-head hydrostations on flat-land rivers, special cranes for operating the gates of outlets and inlets are installed on the bank assembly area with subsequent rolling of the fin-ished crane to the structure. When constructing medium-head hydrostations under conditions of a limited territory, the structural elements of the service cranes are installed by means of rigid braces adjustable in length that use a smaller terri-tory for assembly works. When constructing high-head hydrostations under mountainous conditions, it is necessary to assemble service gantry cranes directly on the structure by means of special jigs. The assembly of the 500-ton-capacity gantry crane of the Sayano-Shushenskoe hydrostation dam serves as an example of assembling service cranes serves as an example of assembling service cranes by means of jigs. Welding of the joints of the crane was performed along with a special inspection of the welding process to merit a 'Certificate of Qual-ity (Assembly)'. (Geiger-PTT) W87-00530

DEVICE FOR OVERLAND TRANSPORT OF A SUCTION DREDGE,

M. M. Fridman

Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 582-587, May 1986. 4 fig. 1 tab, 2 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 11-14, November 1985.

Descriptors: *Dredging, *Hydraulic equipment, *Hydraulic machinery, Cost analysis, Mathemati-

An economic device for transporting dredges overland distances of over 80-100 m was developed by the State Institute for Design of Mechanical Equipment. The device is made in the form of two traveling hoisting supports located on the sides of the dredge, from which the dredge is auspended by means of a block-and-cable system. Suspension is accomplished by special brackets and welded to the dredge hull. Independence of the device for overland transport of the dredge is achieved by the fact that movement of the hoisting supports relative to the dredge is provided by its own winches (spudding winches). A basic calculation scheme for determining the forces and parameters in the device for overland transport of the dredge is presented. Tests of the new method of dredge is presented. Tests of the new method of moving dredges and the device for accomplishing moving dreuges and the everier of accomplishing it showed that by the present method only rough grading of the route is needed, tamping of the soil is not required, there was greater ease of maneu-vering, components of the device could be reused, and personnel needed for operation was minimal. (Ceiger-FTT)

MECHANICAL EQUIPMENT OF THE SECOND LANE OF THE SHEKSNA LOCK.

A. A. Malein, and I. I. Ortikov. A. A. Matein, and I. I. Ortikov. Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 596-601, May 1986. 3 fig. 1 ref. Translat-ed from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 20-24, November 1985.

Field 8—ENGINEERING WORKS

Group 8C-Hydraulic Machinery

Descriptors: *Locks, *Hydraulic machinery, *Hydraulic equipment, Design criteria, Navigation, Mechanical equipment.

Mechanical equipment.

During the design of the second lane of the Shekana lock, considerable innovations were introduced both in the composition of the equipment and in parts of traditional structures. When designing the layout of the lock the following were taken into account: the use of a gantry crane on the lock; the need to extend the established guaranteed navigation periods, and provision of the lock with equipment ensuring its operation at negative temperatures related to this. The mechanical equipment of the upper head, lower head, culverts, and chambers are described. The thorough development of the technical design made it possible to select a variant of the mechanical equipment most corresponding to the conditions of reliability of its operation and current requirements of reducing the labor intensity of maintaining mechanical equipment. The design of the second lane of the Shakana lock and the working out of problems with its mechanical equipment should facilitate the designing of the second lanes of the Shakana lock and the working out of problems with its mechanical equipment should facilitate the designing of the second lanes of other locks. (Geiger-PTT)

MECHANICAL EQUIPMENT OF THE WATER-SUPPLY SYSTEM OF NUCLEAR AND

WATER-SUPPLY SYSTEM OF NUCLEAR AND THERMAL POWER STATIONS, V. N. Sheremet'ev, and T. I. Kashik. Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 610-618, May 1986. 9 fig. 1 tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 31-35, November 1985.

Descriptors: *Hydraulic machinery, *Hydraulic equipment, *Water supply, *Thermal powerplants, *Nuclear powerplants, Hydroelectric plants, Powerplants, Intakes, Pumping, Fish barriers.

The mechanical equipment of the water-supply system of nuclear and thermal power stations func-tion to deliver water of the required amount, cer-tain temperature, and free from mechanical admixtuni temperature, and free from mechanical admix-tures to the condensors of the turbine. The four basic schemes of water-supply systems are: once-through; mixed; recirculation with cooling towers or sprinkling basin; and recirculation with a cool-ing pond. A description is given of the mechanical structures used in these sets cannot cohesical structures used in these water-supply schemes, along with the purpose and characteristics of each structure. Included are: flood and release outlets, structure. Included are: flood and release outlets, circulation pumping stations, pumping stations of the first and second lifts, pumping stations of makeup water (additional water), pumping stations of cooling towers and sprinkling bassins, sluice off-take regulators, cutoff and switching works of waste channels, tail walls of waste channels, pumping stations and works of clarified water channels, and fish barriers. The ability to unify assemblies and articles makes it possible to quickly provide power installations under construction with technical documents of a high quality and to manufacture and deliver equipment in good time. (Geiger-PTT) PTT) W87-00537

UNIVERSAL GATE CHAMBER AS THE BASIS OF UNIFYING MECHANICAL EQUIPMENT OF BOTTOM OUTLETS, Y. I. El'manov, S. V. Farmkovakii, and I. F.

Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 618-623, May 1985. 5 fig. 2 ref. Translated from Gidroteknicheskoe Stroitel'stvo, No. 11, p 36-39, November 1985.

Descriptors: *Hydraulic equipment, *Bulkhead gates, *Universal gate chamber, *Gate chambers, *USSR, Mechanical equipment, Outlets, Reser-

The State All-Union Construction and Installation Trust attaches special importance to unification of mechanical equipment. As a result of many years of work, the design of a universal gate chamber was developed which included an outlet equipped with the country of the state of the country of th with three rows of gates (bulkhead, emergency-guard, and special vertical service). The bulkhead

gate should have its own maintainability regardless of the reservoir level; the distance between the bulkhead gates and the emergency-guard gates is not regulated and the bulkhead gate can be extended beyond the limits of the gate chamber. The distance between the emergency-guard and service gates should be minimum, but not less than 3.5 m in order to perform works. When selecting the number of openings of bottom outlets and their geometric dimensions, preference should be given to variants which permit using standard-size equipment. Standard-size mechanical equipment can be used in layouts of bottom outlets of the type found at Nurek, Charvak, and Rogun hydrostations. Charvak, and Rogun hydro

CLASSIFICATION OF SMALL HYDROELEC-TRIC STATIONS AND STANDARDIZATION OF THEIR UNITS,

OF THEIR OTHS,
M. F. Krasil'nikov.
Hydrotechnical Construction HYCOAR, Vol. 19,
No. 11, p 628-634, May 1986. 8 fig. 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11,
p 53-56, November 1985.

Descriptors: *Hydroelectric plants, *Turbines, *Electric powerplants, *Electrical equipment, *Electric powerplants, Standards, USSR.

Microhydroelectric stations may be classified as hydroelectric stations with a capacity of <0.1 MW, minihydroelectric stations with a capacity of 0.1-1 MW, and small hydroelectric stations with a capacity of 1-10 MW. In foreign practice axial vertical and horizontal straight-flow units and bulb and tube turbines are used for low-head plants, depending on the local conditions. For mediumhead plants the most suitable system is a mixed-flow turbine with a horizontal or vertical shaft and fixed or adjustable gate apparatus. Pelton wheels are used for high heads. For the purposes of equipment unification, the four most widespread types and layouts of turbine equipment are: vertical propeller with fixed adjustment of the runner blades, horizontal axial with an S-shaped draft tube and outlying horizontal generator; horizontal axial straight-flow with an outlying vertical generator; and vertical mixed with a curved draft tube and vertical generator. The main parameters of the turbine can be determined approximately (with consideration of the head and turbine setting) from the nomogram compiled for each type of turbine. To provide reliable operation of the equipment, the following protection with transmission of the signal to the control point can be included: for the turbines - high temperature of the bearings, mechanical brakes, decrease of oil pressure; for generators - excess of speed, overload, overheating, reverse power, shortcircuiting, 'grounding' in the excitation system; for the auxiliary equipment - loss of voltage and protection. (Geiger-PTT) Microhydroelectric stations may be classified as

8D. Soil Mechanics

HYDROLOGY OF A SLOPING, STRUCTURED CLAY SOIL AT WYTHAM, NEAR OXFORD, ENGLAND, Helix Software Consultants, London (England). For primary bibliographic entry see Field 2G. W87-40151

EARTH DAM CONSTRUCTION BY DOLO-MITE FILLED INTO WATER, State Organization for Dams, Baghdad (Iraq). Al-Qadisiya Dam Establishment. A. R. Kh. Salem.

Journal of Geotechnical Engineering (ASCE) JGENDZ, Vol. 112, No. 5, p 510-521, May 1986. 7 fig. 4 tab, 6 ref.

Descriptors: *Dam construction, *Earth dams, *Dolomite, *Compaction, Field tests, Al-Qadisiya Dam, Iraq, Haditha Dam, Soil structure.

A method of compacting dolomite into water as a part of Al-Quadisiya Dam (Iraq, called Haditha Dam until November 1984) core construction is

discussed in light of laboratory and field tests. Main characteristics of dolomitic soils are compared with the requirements for soils suitable to be placed by this method. Special uses of this method as performed in the Al-Qudisiya Dam construction are described. Limitations and shortcomings of this technology are discussed for the dolomitic soils filled into the core of the dam. It is concluded that the method of compacting dolomite into water is acceptable for dam construction, with satisfactory filling of sumps and large depressions and meeting quality control requirements. The method provides good contact with the foundation material. (Rochester-PTT) W87-00210

SLIDE IN UPSTREAM SLOPE OF LAKE SHELBYVILLE DAM,
Purdue Univ., Lafayette, IN. School of Civil Engi-

D. N. Humphrey, and G. A. Leonards. Journal of Geotechnical Engineering (ASCE) JGENDZ, Vol. 112, No. 5, p 564-577, May 1986. 10 fig. 3 tab, 9 ref.

Descriptors: *Lake Shelbyville Dam, *Dam fail-ure, *Earth dams, Illinois, Slope stability, Pore water pressure, Dam construction, Stress stability, Shear strength, Soil compaction, Clay.

Key features of embankment design and construc-tion are discussed with reference to a slide that occurred on the upstream slope of Lake Shelby-ville Dam (Kaskaskia River, central Illinois) in 1972, soon after dam construction, but prior to filling of the reservoir. The dam is a 108-ft high earth dam completed in 1970. The nature and chronology of the slide is described here and data on movements, shear strengths, and pore pressures are examined. Possible failure mechanisms are in-vestigated and an explanation for the slide is given. Re-examination of construction records revealed a layer of more plastic, weaker fill in the closure section at the elevation at the base of the slide. Movements were gradual because the well-com-pacted clay soil tended to dilate when sheared, which induced negative excess pore water prespacted clay soil tended to dilate when sheared, which induced negative excess pore water presures that temporarily increased the strength of the failure zone. As drainage occurred, the effective stresses acting on the failure surface decreased with time and the shear strength was reduced from that corresponding to undrained shear. Accordingly, total stress analysis, using undrained shear strength, is not a reliable index of stability in well-compacted, silv clay fills. (Rochester-PTT) compacted, silty clay fills. (Rochester-PTT) W87-00211

EXAMPLE OF A PEAT FLOW NEAR PRINCE RUPERT, BRITISH COLUMBIA,

Thurber Consultants Ltd., Vancouver (British Columbia). For primary bibliographic entry see Field 2J. W87-00280

SALVAJINA: A CONCRETE-FACED DAM ON A DIFFICULT FOUNDATION,

Ingetec S.A., Bogota (Colombia).
J. E. Hacelas, and C. A. Ramirez.
International Water Power and Dam Construction,
Vol. 38, No. 6, p 18-24, June 1986. 12 fig. 3 tab, 11

Descriptors: *Concrete-faced dams, *Dam founda-tions, Colombia, Gravel-rockfill dams, Embank-ment zoning, Toe slab design, Soft rocks, Leakage,

The Cauca River Regulation Project which includes the Salvajina Dam is in southwest Colombia. The 148 m-high Salvajina Dam is the second highest concrete-faced, gravel-rockfill dam in the world. The dam is on a difficult and variable foundation, which required the implementation of several corrective methods in the toe slab design and in the foundation, teatment. Embarture. and in the foundation treatment. Embankment zoning permitted the economical use of soft rock from the required excavations in combination with gravel. The dam was completed in late 1984, and upon filling for the second time in 1986, leakage

Fisheries Engineering—Group 81

was found to be negligible and settlement normal.

TECHNOLOGY OF HYDRAULIC FILLING OF STRUCTURES FROM LOESSIAL LOAMS WITH INTENSIFICATION OF THEIR DEWA-

D. L. Melamut, and R. Z. Utyaganov. Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 576-581, May 1986. 5 fig, 1 ref. Translat-ed from Gidrotekhnicaskoe Stroitel'stvo, No. 11, p 7-11, November 1985.

Descriptors: *Earth dams, *Earthworks, *Dam construction, *Loess, *Loams, Soil water, Soil mechanics, Cost analysis, Embankments, Reservoirs, Dewatering, Design criteria, Dam foundations, Dam design, Evaporation, Hydraulic fill, Hydraulic-fill dams.

It is expedient to use the hydraulic-filling method of placing the soils with intensification of their dewatering and compaction when constructing earth dams and embankments from loessial loams. Intensification of dewatering and compaction is achieved by natural drying and moisture exchange between the fresh hydraulic fill and dry soil. The cost of placing soil in the recommended structured technology decreases by 20-30% compared with the rolled-fill method as a result of a reduction in labor expenditures and earthmoving and transport. When planning the recommended technology of hydraulic filling of structures it is necessary to take into account the main technological and design parameters and geotechnical characteristics such as time of dewatering the hydraulic fill to the optimal moisture content, dry density of the hydraulic fill, and its fractional composition. The present method was used in constructing the loam stretches of the dam of the second phase of the Kopet Dag reservoir. (Geiger-PTT)

ANALYZING PERMANENT DRIFT DUE TO CYCLIC LOADS,
Norges Geotekniske Inst., Oslo.
G. Bouckovalas, W. A. Marr, and J. T. Christian.
Journal of Geotechnical Engineering (ASCE)
JGENDZ, Vol. 112, No. 6, p 579-593, June 1986.
12 fig, 4 tab, 13 ref.

Descriptors: *Load distribution, *Mathematical models, *Soil mechanics, *Permanent drift, Finite element method, Mathematical studies, Mathemati-

An analytical model has been developed to predict An analytical model has been developed to predict permanent stresses and strains in sands under cyclic loading for general drainage and boundary conditions. Here the model is combined with the finite element method to predict the permanent displacement of a storm barrier under combined tidal and wave loading. The results are compared with predictions from previous analyses, yielding a good correlation. The effects of drainage conditions and soil densification on permanent displacement are evaluated. The results demonstrate the importance of including in the pore pressure calculation the effects of both the tendency for volume change and the change in the average total stress. (Author's abstract)

DEVELOPMENT AND APPLICATION OF A COMBINED SOIL WATER-SLOPE STABILITY

MODEL, Bristol Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 2G. W87-00759

8E. Rock Mechanics and Geology

ROCK EROSION, Royal Inst. of Tech., Stockholm (Sweden). E. Reinius. International Water Power and Dam Construction,

Vol. 38, No. 6, p 43-48, June 1986. 9 fig, 8 tab, 3 ref.

Descriptors: *Rocks, *Erosion, *Flumes, Water pressure, Joints, Uplift forces, Turbulence, Pres-sure coefficients.

Eight model tests were performed in a flume to measure the water pressures around a simulated rock block. A bottom with vertical joints and with small vertical displacement heights between the blocks was tested. Joints with different angles to the vertical, simulating excavated rock surfaces or sedimentary rock with joints or layers inclined, were also tested. Results of the testing program showed pressure coefficients up to c = 0.67 existed in joints of the simulated rock mass. On the leeside of the protrusion negative pressure coefficients existed. Experience with supercritical flow downstream of spillways has shown that erosion will occur to only a small extent or not at all in rock of good quality in which the rock blocks between joints or cracks are large and interlocked. (Main-PTT)

INFLUENCE OF THE KARST SPRING SUB-MERGENCE ON THE KARST AQUIFER

Karst Water Research Inst., Trebinje (Yugoslavia). For primary bibliographic entry see Field 2F. W87-00638

EFFECT OF SEDIMENT ON EARTHQUAKE-INDUCED RESERVOIR HYDRODYNAMIC

Delaware Univ., Newark. Dept. of Civil Engineer-For primary bibliographic entry see Field 8B. W87-00732

ANALYZING PERMANENT DRIFT DUE TO

CYCLIC LOADS, Norges Geotekniske Inst., Oslo. For primary bibliographic entry see Field 8D. W87-00733

8F. Concrete

SALVAJINA: A CONCRETE-FACED DAM ON A DIFFICULT FOUNDATION, Ingetec S.A., Bogota (Colombia). Por primary bibliographic entry see Field 8D.

CONDITION OF THE CONCRETE DAM OF THE TOKTOGUL HYDROELECTRIC STATION ACCORDING TO ON-SITE OBSERVA-

TION ACCORDING TO ON-SITE UBSERVA-TION DATA,
S. A. Berezinskii, F. G. Enikeev, K. I. Maksimov,
G. K. Khakinova, and M. S. Kazachenko.
Hydrotechnical Construction HYCOAR, Vol. 19,
No. 9, p 470-478, March 1986. Translated from
Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 17-23,
September 1983. 7 fig. 4 tab, 7 ref.

Descriptors: *Concrete Dams, *On-site investiga-tions, *Structural behavior, Hydraulic engineering, Hydroelectric plants, Concrete testing, Perform-ance evaluation, Grouting.

ance evaluation, (Frouting.

The Toktogul triangular concrete dam, USSR, was constructed in a narrow canyon and is 215 m high with a 173 m wide base along the flow. The increase, compared with the design, of tensile stresses on the faces, caused by deviation of the temperature regime of the concrete, does not pose a danger for the structure. The absence of substantial disturbances of the solidity of the structure, indicates a high level of observance of the specifications when constructed, substantiation of the adopted sizes of the concreting blocks, and the effectiveness of the cooling and monitoring means being used. The grout curtain, consolidation grouting of the foundation, and developed drainage system under the dam and in the wall abutments of the foundation provide effective reduction of the seepage heads in the foundation and absence of

escape of the seepage flow onto the walls near the downstream face. The settlement of the dam, now relatively stabilized, was less than calculated. The process of deformation of the joints after grouting has stabilized. (McFarlane-PTT)

8G. Materials

DEZINCIFICATION UPDATE.

T. C. Jester. American Water Works Association JAWWA5, Vol. 77, No. 10, p 67-69, October 1985. 1 fig, 8 ref.

Descriptors: *Dezincification, *Copper, *Zinc, *Corrosion, Valves, Hydrogen ion concentration, Conductance, Alkalinity, Brass.

The occurence of dezincification in valves and fittings made of brass alloys with a high content of zinc has caused relatively few problems in the United States although it is a problem in many parts of Europe and abroad. This is due to AWWA standards that call for the use of low-zinc brass alloys. However, not all waters would subject high-zinc brass to dezincification, so water suppliers should be aware of the mechanism and the causes and effects of this type of corrosion. Experimental studies regarding water characteristics that promote layer type dezincification concluded that three water quality factors should be considered: (1) chloride content, (2) temporary hardness or alkalinity and (3) pH. A literature review and a summary of findings in studies undertaken since 1955 on dezincification are provided. (Author's abstract) abstract) W87-00437

8I. Fisheries Engineering

FISH RECRUITMENT AND MOVEMENT IN A FLOOD CONTROL RESERVOIR AND TAIL-

Fish and Wildlife Service, Bowling Green, KY.
National Reservoir Program.
K. E. Jacobs, W. D. Swink, J. M. Nestler, and L.
T. Curtis.

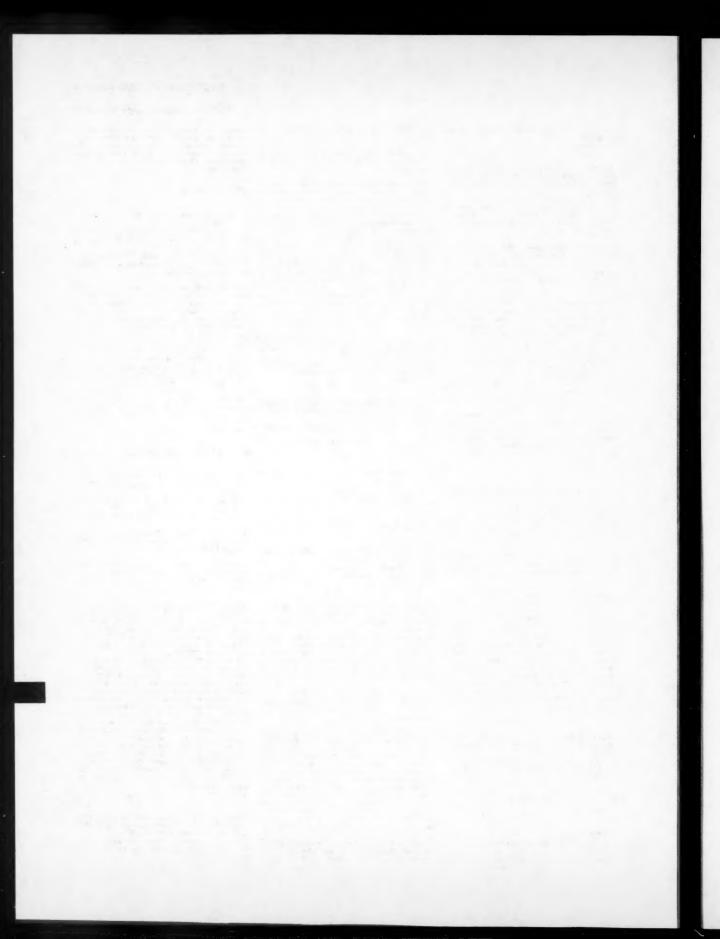
Final Report. Technical Report E-85-15, December 1985. 60 p, 12 fig. 16 tab, 24 ref. Contract No. DACW39-83-M-0631.

Descriptors: *Reservoirs, *Fish migration, *Fish guiding, *Flood-control storage, *Tailwater, Fish-eries, Fish behavior, Fish populations, Ecology, Barren River Lake, Kentucky.

Barren River Lake, Kentucky.

This report identifies factors that alter the relative abundance of tailwater fishes. Specifically, the objectives of this study were to determine the significance of fish recruitment from the reservoir into the tailwater, determine which species are recruited from the reservoir, identify conditions in the tailwater that foster the concentration of fish, identify the season of recruitment, and describe the direction and season of movement of tailwater fishes. To meet these objectives, fish were intensively sampled, marked, and recaptured in the immediate tailwater of Barren River Lake, Ky., for 1 year. Analyses of the resulting data indicated that the reservoir may be the source of recruitment for the most abundant fish in the tailwater of deep-release, flood control reservoirs; the passage of fish from the reservoir into the tailwater exhibits pronounced seasonality; the seasonality of fish passage can be related to conditions in the reservoir relative to the behavior of certain common fishes; and project operation can have substantial effects on the tailwater. (Author's abstract) W87-00038

ELECTROSTATIC MECHANISM OF SURVIV-AL OF VIRULENT AEROMONAS SALMONI-CIDA STRAINS IN RIVER WATER, Hokkaido Fish Hatchery, Sapporo (Japan). For primary bibliographic entry see Field 5C. W87-00261



ABSORPTION Reactive Scavenging of Pollutants by Rain: A	Influence of Saharan Dust on the Rain Acidity and Atmospheric Input to the Mediterranean,	Atmospheric Concentrations and the Deposition Velocity to Snow of Nitric Acid, Sulfur Dioz-
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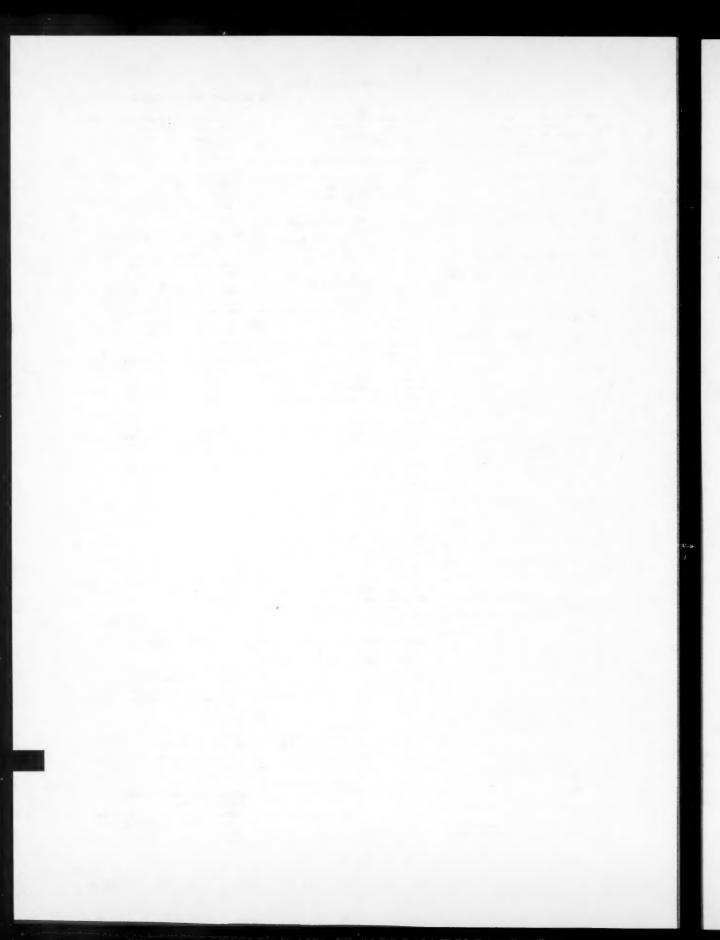
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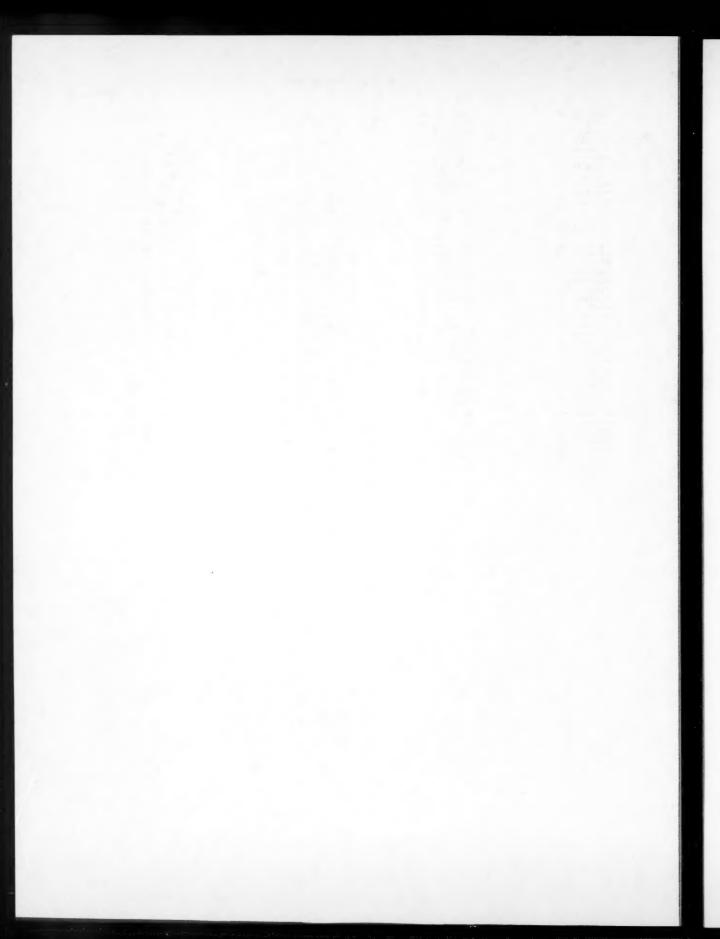
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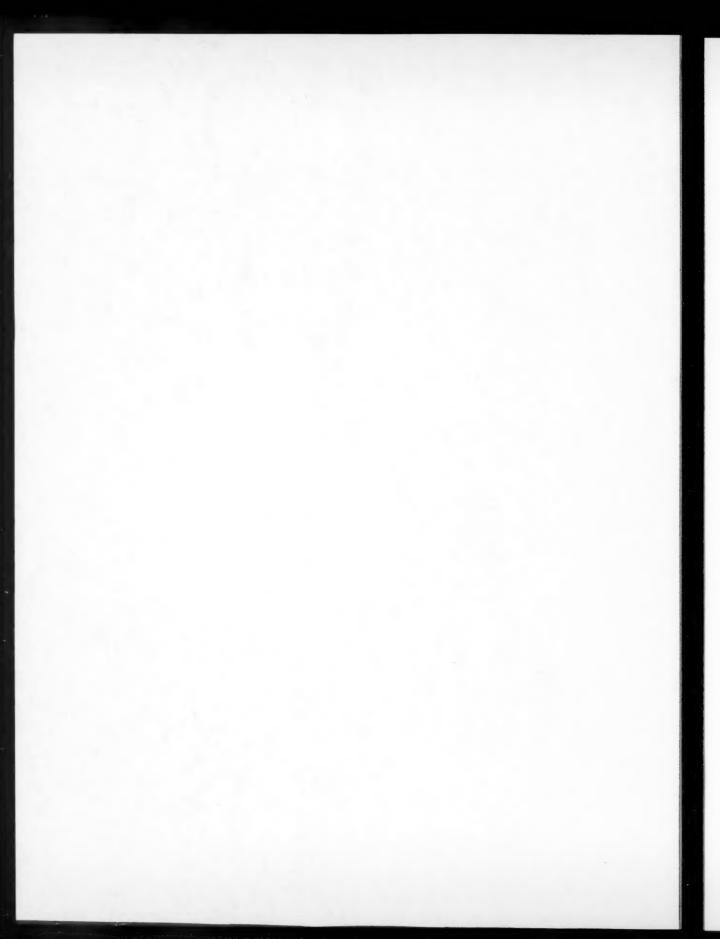
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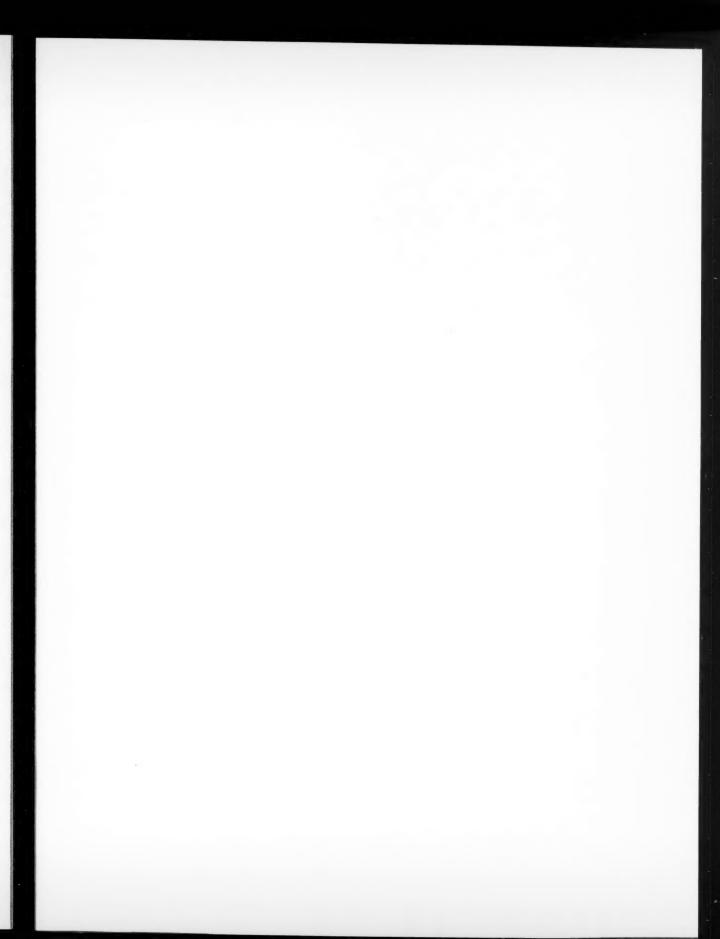
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W87-00388	5F	W87-00472 3F	W87-00556 2I	W87-00639 2E
W87-00389	2B	W87-00473 6A	W87-00557 2I	W87-00640 2E
W87-00390	2B	W87-00474 6A	W87-00558 2I	W87-00641 2E
W87-00391	2B	W87-00475 6A	W87-00559 2H	W87-00642 5F
W87-00392	2L	W87-00476 6A	W87-00560 2H	W87-00643 6D
W87-00393	5F	W87-00477 2H	W87-00561 5C	W87-00644 5F
W87-00394	5C	W87-00478 5B	W87-00562 2H	W87-00645 5D
W87-00395	2H	W87-00479 2H	W87-00563 2H	W87-00646 5C
W87-00396	5D	W87-00480 5C	W87-00564 2H	W87-00647 2L
W87-00397	5B	W87-00481 5C	W87-00565 2H	W87-00648 2K
W87-00398	2B	W87-00482 5C	W87-00566 5A	W87-00649 5E
W87-00399	3F	W87-00483 5D	W87-00567 2H	W87-00650 5E
W87-00400	5C	W87-00484 2K	W87-00568 2H	W87-00651 5E
W87-00401	5F	W87-00485 2B	W87-00569 2H	W87-00652 5B
W87-00402	5F	W87-00486 5G	W87-00570 2I	W87-00653 5A
W87-00403	2E	W87-00487 5B	W87-00571 5C	W87-00654 5B
W87-00404		W87-00488 2F	W87-00572 2H	W87-00655 5F
W87-00405		W87-00489 2I	W87-00573 2H	W87-00656 5C
W87-00406	5F	W87-00490 3E	W87-00574 2L	W87-00657 5C
W87-00407		W87-00491 7A	W87-00575 2H	W87-00658 5C
W87-00408	5F	W87-00492 5D	W87-00576 2H	W87-00659 5E
W87-00409		W87-00493 7A	W87-00577 2I	W87-00660 5C
W87-00410	5C	W87-00494 2J	W87-00578 2H	W87-00661 5D
W87-00411		W87-00495 5B	W87-00579 3B	W87-00662 5B
W87-00412	5A .	W87-00496 2C	W87-00580 2B	W87-00663 5B
W87-00413		W87-00497 2G	W87-00581 2B	W87-00664 5C
W87-00414		W87-00498 2L	W87-00582 2B	W87-00665 4A
W87-00415		W87-00499 2H	W87-00583 2F	W87-00666 5C
W87-00416	5B	W87-00500 2E	W87-00584 2F	W87-00667 2F
W87-00417	5B	W87-00501 6C	W87-00585 2F	W87-00668 2H
W87-00418			W87-00586 2F	W87-00669 2I
W87-00419	2B	W87-00503 5F	W87-00587 2E	W87-00670 2I

W87-00671	2E	W87-00712	5G	W87-00753	6F	W87-00794	5B
W87-00672	7C	W87-00713	5G	W87-00754	5G	W37-00795	5A
W87-00673	2F	W87-00714	5B	W87-00755	5D	W87-00796	2H
W87-00674	2F	W87-00715	5G	W87-00756	5C	W87-00797	2H
W87-00675	2F	W87-00716	5G	W87-00757	2L	W87-00798	21
W87-00676	5G	W87-00717	5G	W87-00758	21	W87-00799	21
W87-00677	5C	W87-00718	5G	W87-00759	2G	W87-00800	2H
W87-00678	5B	W87-00719	5G	W87-00760	5D	W87-00801	2H
W87-00679	5G	W87-00720	5G	W87-00761	5A .		-
W87-00680	5F	W87-00721	5C	W87-00762	5D	W87-00802	5A
W87-00681	5A	W87-00722	3C	W87-00763	5D	W87-00803	8A
W87-00682	5A	W87-00723	5C	W87-00764	5G	W87-00804	2L
W87-00683	5B	W87-00724	3C	W87-00765	5D	W87-00805	2L
W87-00684	5B	W87-00725	5C	W87-00766	5D	W87-00806	3C
W87-00685	5B	W87-00726	2K	W87-00767	5D	W87-00807	3C
W87-00686	5G	W87-00727	5A	W87-00768	6B	W87-00808	5C
W87-00687	5B	W87-00728	5D	W87-00769	5B	W87-00809	5F
W87-00688	5A	W87-00729	2B	W87-00770	5B	W87-00810	2E
W87-00689	3C	W87-00730	5B	W87-00771	7A	W87-00811	2F
W87-00690	2E	W87-00731	5C	W87-00772	2B	W87-00812	2G
W87-00691	5C	W87-00732	8B	W87-00773	2A	W87-00813	2A
W87-00692	5C	W87-00733	8D	W87-00774	2A	W87-00814	5A
W87-00693	5C	W87-00734	5A	W87-00775	5B		2E
W87-00694	5B	W87-00735	2F	W87-00776	6B	W87-00815	
W87-00695	2H	W87-00736	4B	W87-00777	2E	W87-00816	2F
W87-00696	2H	W87-00737	5G	W87-00778	2E	W87-00817	2F
W87-00697	2H	W87-00738	5G	W87-00779	2A	W87-00818	2F
W87-00698	2H	W87-00739	5G	W87-00780	2F	W87-00819	2D
W87-00699	5B	W87-00740		W87-00781	2F	W87-00820	5B
W87-00700	2H	W87-00741	5F	W87-00782	2F	W87-00821	2E
W87-00701	5B	W87-00742		W87-00783	2F	W87-00822	5G
W87-00702	5B	W87-00743		W87-00784	2G	W87-00823	2E
W87-00703	2H	W87-00744		W87-00785	7B	W87-00824	2E
W87-00704	5C	W87-00745	5B	W87-00786	2D	W87-00825	8B
W87-00705	5C	W87-00746		W87-00787	2E	W87-00826	
W87-00706	2H	W87-00747		W87-00788	2F	W87-00827	2E
W87-00707	2H	W87-00748		W87-00789	5A		8B
W87-00708	5D	W87-00749		W87-00790		W87-00828	
W87-00709	2K	W87-00750		W87-00791	5C	W87-00829	
W87-00710		W87-00751		W87-00792	5A -	W87-00830	
W87-00711	5C	W87-00752	5G	W87-00793	5B	W87-00831	5C









Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION 3 AND CONSERVATION
- WATER QUANTITY MANAGEMENT 4 AND CONTROL
- WATER QUALITY MANAGEMENT 5 AND PROTECTION
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NORTH AMERICAN CONTINENT PRICE SCHEDULE

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MICROFICHE	PAPER COPY	DISKETTES	MAGNETIC TAPES	
A01\$6.50	£01\$7.50	001\$50 00	T01\$156.00	
A02 9.95	E0210.00	D0275.00	T02175.00	
A03 11.95	E0311.00	D03 125.00	T03300.00	
A04-A05 13.95	E0413.50	D04 175.00	T04400.00	
A06-A09 18.95	E0515.50	D05 225.00	105500.00	
A10-A13 24.95	E0618.00	D06 275.00	T06600.00	
A14-A1730.95	E07	D07 325.00	T07700.00	
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A22-A2542.95	E0925.50	D09 425.00	T09900.00	
A99	E1028.00	010 475.00	T101,000.00	
	£1130.50	011 525.00	T111,100.00	
	E1233.00	012 575.00	T121,200.00	
NO145.00	E1335.50	D13 625.00	T131,390.00	
NO248.00	E1438.50	D14 675.00	T141,400.00	
	E1542.00	D15725.00	1151,500.00	
	E1646.00	D16 775.00	1161,600.00	
	£1750.00	D17 825.00	1171,780.00	
	E1854.00	D18 875.00	T181,800.00	
	E1960.00	D19 925.00	T191,900.00	
	E2070.00	D99	T99	
	£99			

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